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The Journal of Orthopædic Surgery

CALCANEO CAVUS AND ITS TREATMENT

By Major Naughton Dunn, R. A. M. C., Birmingham.

Paper read at the meeting of the British Orthopaedic Association, 30th May, 1919.

Calcaneo Cavus and Its Treatment.

Calcaneo Cavus is one of the most crippling of the deformities which follow Infantile Paralysis.

The condition demands special consideration by the Orthopaedic Surgeon, because once the deformity is established, treatment by splintage is difficult and usually ineffective.

Many of the appliances supplied by the instrument maker are heavy and cumbersome and when removed the deformity is seen to be still present.

In the early stages of this condition, the child is unable to raise the heel from the ground in walking, later the heel drops, the pillars of the longitudinal arch of the foot are drawn together and eventually the heel becomes a peg on which the patient walks, while the anterior portion of the foot becomes an atrophied and useless appendage. Associated deformities of the foot, such as Varus and Valgus will also tend to develop, owing to faulty incidence of body weight or unequal muscular action.

Cause of Calcaneo Cavus and Associated Deformities.

In Infantile Paralysis we notice that where paralysis of all the muscles controlling the foot is complete, there is usually little actual deformity. Where the deformity is most marked we know that some muscles are active; this is always the case in Calcaneo Cavus deformities.

The increase of deformity appears to be due, not to the paralysis of the Tendo Achilles, but to the effort of the other posterior Tibial muscles to assume its function and to the unopposed action of its antagonistic muscles. If the calf muscles are paralysed or much weakened the Tibialis Anticus and Posticus pull up the arch, while the flexor longus digitorum, flexor longus hallucis and Peroneus longus, passing down behind the ankle to their insertions in the front of the foot, draw the pillars of the arch together. As a result the heel drops, the arch rises and the structures on the plantar surface of the foot shorten.

The greater power of the Peroneus Longus frequently accounts for the commonly associated Valgus deformity.

If you examine a radiograph of a typical case of Calcaneo Cavus you will see that the antero posterior arch of the foot is high, and if you examine it more carefully you will see that this is due mainly to a tilting upwards and forwards of the forepart of the os calcis on the astragalus, and a dropping of the forepart of the foot at the medio tarsal joint. The relation of the astragalus to the bones of the leg is not much altered, but owing to the stretching of the posterior ligaments of the ankle from continued strain, the line of the body weight tends to pass almost entirely through the posterior astragalo-calcanean facet to the point of the heel.

Normally the weight of the body is transmitted to the foot through the astragalus, directly to the Os Calcis and indirectly through the Scaphoid and Cuboid to the forepart of the foot.

Movement at the subastragaloid joint is normally slight, but in any deformity of the foot resulting from unusual strain or loss of muscular balance, the relation of the astragalus to the os calcis is altered, although the range of movement occuring at this joint may remain the same. If the astragalus and os calcis were one bone, body weight would be mainly transmitted directly to the os calcis and the effects of dynamic pressure on the weakened muscles and ligaments would not be so often apparent.

I would therefore suggest that in any case of tendency to deformity following Infantile Paralysis, arthrodesis of the subastragaloid joint should at least be part of any operative procedure.

Treatment of Calcaneo Cavus and Associated Deformities.

No agreement has yet been reached by Orthopaedic Surgeons as to the treatment of this condition.

The published methods of which I have had experience are:

1. Shortening of the Tendo Achilles and plication of the posterior portion of the capsule of the ankle joint. This operation has been advised in cases where there is weakness but not paralysis of the Tendo Achilles.

By this operation the weak muscle is permanently stretched. This is a direct contradiction of the axiom, on which we are, I think, all agreed, that relaxation will hasten the recovery of a muscle, which is too weak to perform its function.

This operation may therefore be discarded as unsound both in principle and practice.

2. Davis of Philadelphia makes a transverse incision through the subastragaloid joint, displaces the foot backwards, and if necessary, transplants the peroneal and posterior Tibial Tendons into the Os Calcis.

The results of the operation are good in mild or moderately severe cases. The displacement of the foot backwards is difficult, but the arthrodesis of the subastragaloid joint which results, is a most important factor in increasing the stability of the foot.

3. *Whitman's operation.* Whitman advises the removal of the astragalus through an external incision, the articulating surfaces of the leg bones and os calcis are denuded of cartliage, the foot is then displaced backwards, so that the malleoli overlap the anterior portion of the os calcis. The peroneal tendons, if active, being inserted into the os calcis. The foot is then fixed in plaster in the equinus position with slight valgus for about six weeks and later a brace applied to give further support for some time.

The object of this procedure is to throw the weight of the body more on the centre of the tarsus, so that the cavus is gradually corrected and the security of the foot maintained. My experience of this operation is that it gives a more stable foot, but should recovery take place in the Tendo Achilles or the muscles replacing it, the short fibrous ankylosis resulting does not allow a useful range of movement. Another point to be considered is that the limb is further shortened by ½″ to ¾″ by removal of the astragalus. It should, I think, be reserved as an alternative operation for cases in which paralysis of all the posterior tibial muscles, as well as the Tendo Achilles, is complete.

Case Shown.

A recent cast of a case operated on by this method 4 years ago. The child has now walked for 2½ years without any form of support. There is no tendency to increase of deformity, but the child has not as much control of the foot, as might have occurred if more movement of flexion and extension were possible between the leg bones and the foot.

4. Where paralysis of the calf muscles is complete, the double wedge operation, as practised by Sir Robert Jones has given good results in a large number of cases. The steps of the operation, as published 11 years ago are:

Stage I.

Step 1. If the Plantar fascia is contracted, divide it subcutaneously and straighten the sole by manual or instrumental force.

Step 2. On the inner side of the foot make a 3 inch incision to the bone, the centre of the incision being opposite the convexity on the dorsum. Separate the soft parts from the tarsus with an elevator until the inner dorsal and plantar surfaces are accessible.

Step 3. With a chisel remove a wedge of bone (base above) large enough to completely correct the cavus.

Step 4. Close the wound, correct the cavus by flexing the foot dorsally, and after applying dressings, bandage the foot to the tibia. The cavus is cured, but the calcaneus is apparently much worse.

Stage II. (Four weeks later.)

Step 1. Make a longitudinal incision at the back of the heel, the centre being opposite the ankle joint. Open the joint.

Step 2. Remove a wedge from the Astragalus sufficient to permit the foot being brought at a Right Angle to the leg and arthrodese to the Tibia.

Step 3. Close the wound. Correct the deformity. Immobilise until union is complete.

The results are in many cases excellent, but unless arthrodesis of the subastragaloid joint is also assured, lateral displacements of the os calcis on the astragalus may still occur and give rise to valgus or varus deformity.

The conditions vary so much in each case that it is not possible to publish the various points, which guide one in the treatment of an individual case.

Before deciding on a line of treatment all factors must be considered, the age of the patient, the cause of the deformity, its degree and probable progress, and, perhaps most important of all, an accurate estimate must be made of the power in each muscle controlling the foot.

Our consideration of these points can only be effective if we also recognise the relative importance of the various movements of the foot. The human foot is adapted mainly for support and locomotion, and for these it depends largely on its muscular control. The most important movements in propulsion of the body are controlled flexion and extension of the foot at the ankle. We must therefore endeavour to retain these, sacrificing elasticity if necessary. We can assure stability by substituting bony for ligamentous union between the mediotarsal and subastragaloid joints.

For actual muscular control of extension of the ankle we must depend as a rule on transplanted muscles, but we can make their action more effective if necessary by displacing the foot backwards and so increasing their leverage.

I propose to give in detail the methods I have found most effective.

Case 1. Tendo Achilles weak, no deformity,—child does not raise heel from the ground in walking and is unable to stand on tip-toe. Passive dorsiflexion of the foot greater than on normal side.

Treatment. Fixation of the foot in equinus position for three to six months, followed by a brace to prevent dorsiflexion of the foot beyond a right angle and raising the heel of the boot half an inch.

Massage, electrical treatment and controlled exercises should be continued.

This postural and direct treatment of the muscles will also be advisable in the after treatment of all cases in which operation has been found necessary.

Case 2. Similar to Case 1, but dropping of the heel more noticeable and some cavus present.

Treatment. Arthrodesis of the subastragaloid joint. This is performed through lateral incisions below each malleolus,—the foot being displaced backwards. This is followed by postural treatment as in Case 1.

Case 3. No power in Tendo Achilles, but other posterior tibial muscles active. Heel walk more apparent. Moderate cavus present with some contracture of the plantar fascia. Complete passive correction of the calcaneus deformity still possible.

Treatment 1. The Plantar fascia is divided and the sole of the foot straightened out by manipulation.

2. The subastragaloid joint is exposed through posterior incision, and the cartilage removed from its surfaces. The Peroneus Longus, Flexor Longus Hallucis and Flexor Longus Digitorum are transplanted to an insertion in a groove on the posterior surface of the Os Calcis. The foot is then fixed in the equinus position for eight to ten weeks. After-treatment same as in Case 1.

Case 4. No power in Tendo Achilles, other posterior tibial muscles hypertrophied, complete heel walk with extreme cavus. Passive correction of cavus and calcaneus deformities is not possible.

The patient has been walking on the posterior surface of the heel for years, and the fore-part of the foot has become a useless appendage.

This is the most satisfactory type of case from the Orthopaedic surgeon's point of view, as the greater the degree of deformity, the most satisfactory the after result is likely to be.

Treatment 1. The plantar fascia is divided with a tenotome, and the cavus deformity corrected as much as possible by manipulation or moderate wrenching. If we attempt to exert the extreme force of the Thomas Wrench in such a case, a plantar dislocation of the fore part of the foot results.

2. Through a four inch incision over the outer part of the dorsum of the foot between the tendons of the extensor longus digitorum and the peroneus tertius, a clear subperiosteal exposure of the mid tarsus is obtained. A bony wedge is then removed, base upwards, which allows correction of the cavus deformity. This will involve the greater part of the scaphoid and the calcaneo cuboid joint.

3. The child is next turned on its face and a long shaped incision made over the posterior surface of the ankle.

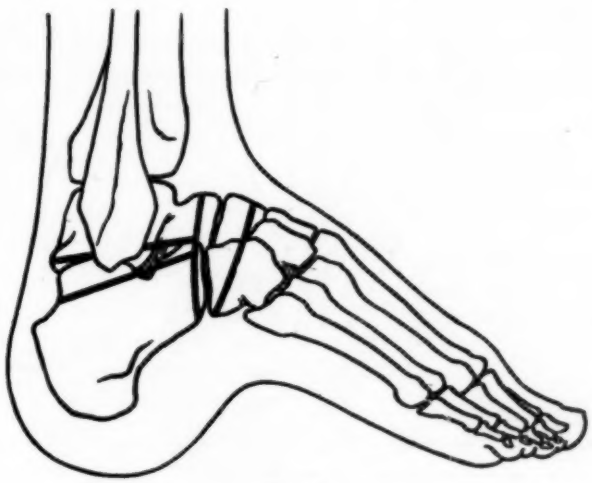

FIG. I

Showing Wedge of Bone Removed

The Tendo Achilles is retracted and all the remaining tendons of the Posterior Tibial and Peroneal groups exposed and divided as far forwards as possible.

A wedge of bone, base backwards, is now removed from the astragalus and os calcis. The wedge should include the subastragaloid joint and extend forwards to the mid tarsal resection. It should be cut so as to allow easy correction of the calcaneus, as well as any associated valgus or varus deformities.

The foot may now be looked upon as consisting of three sections:

An Upper, formed by the portion of the astragalus articulating with the tibia and fibula;

A Lower, formed by the remainder of the os calcis; and an Anterior, consisting of a portion of the scaphoid and cuboid bones, with the remaining fore-part of the foot.

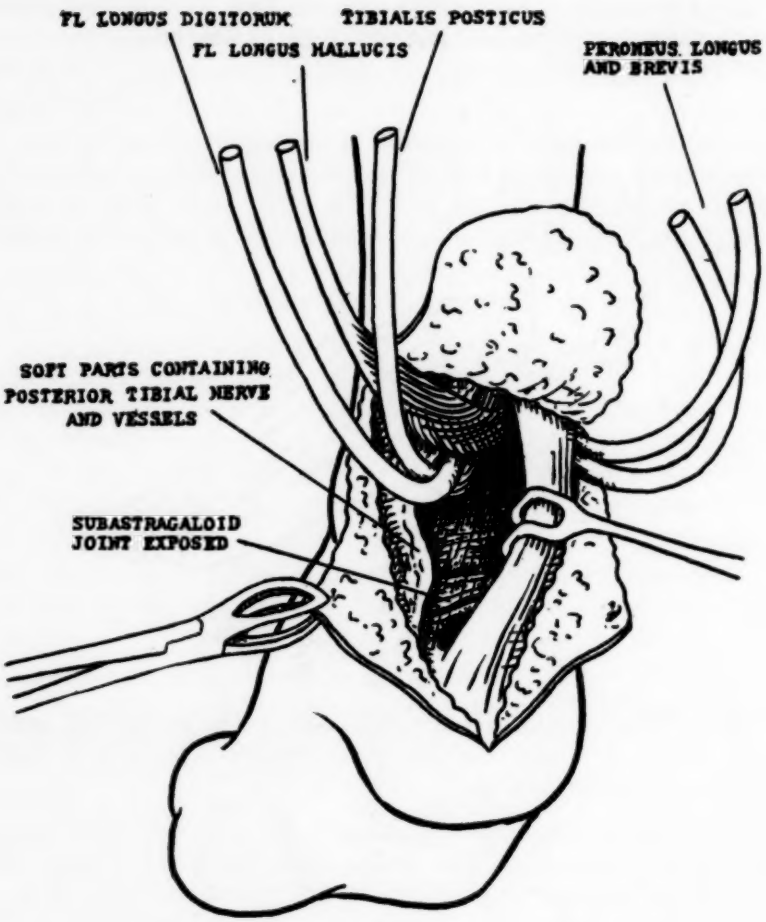

FIG. II

Deep Tendons Isolated and Subastragaloid Joint Exposed

4. The Tendo Achilles is next split into an anterior and posterior layer in its lower two inches. With a small gouge, passed between these layers, a hole is bored in the posterior extremity of the os calcis. This must be large enough to receive the transplanted tendons.

The foot is then put in the equinus position and the tendons cut so that when taut they just pass into the bed prepared for them in the receiving bone. The lower two inches of the transplanted

tendons are first roughened with a scalpel or toothed forceps, so that they may readily unite with the recipient tendon.

The Peroneus brevis and longus are then united to one another by means of chromicised catgut and guided into the groove prepared for them in the os calcis. The same procedure is adopted with the flexor longus hallucis, flexor longus digitorum and tibialis posticus.

The method of fixing these tendons in the groove is, I think, important:

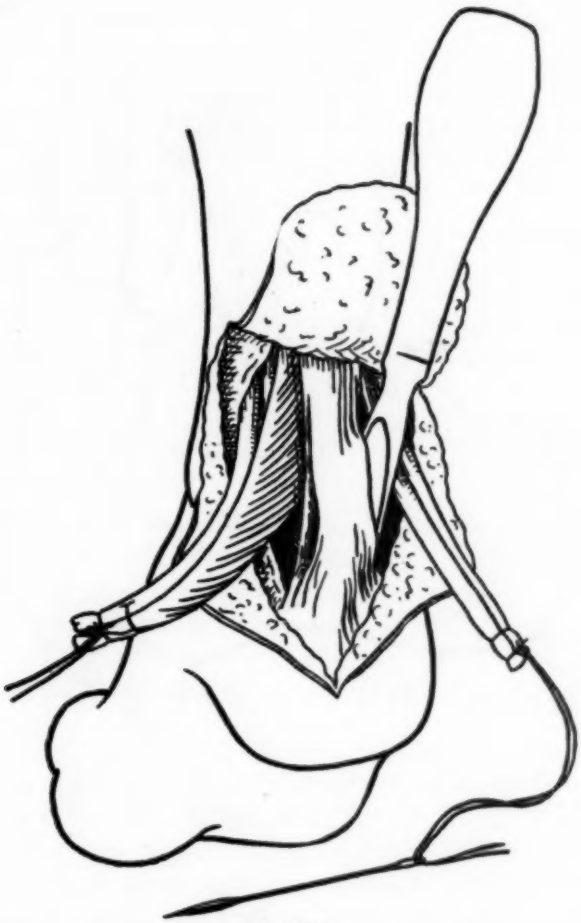

FIG. III

Deep Tendons Sutured in Two Groups. Bed Prepared in Os Calcis. for Their Reception.

The tendons are cut the required length, No. 3 Chromicised catgut is used, either as a loop or suture, to unite the extremities of each group of tendons. Each catgut is then threaded on a long straight needle, which is passed between the two layers of the tendo achilles and through the groove in the os calcis to emerge on the sole of the foot. The two loops are brought to the surface about ¼" apart. Then, while the position of the plantar flexion of the foot is maintained, these directing catgut sutures are tied on the sole of the foot over a small pad of gauze.

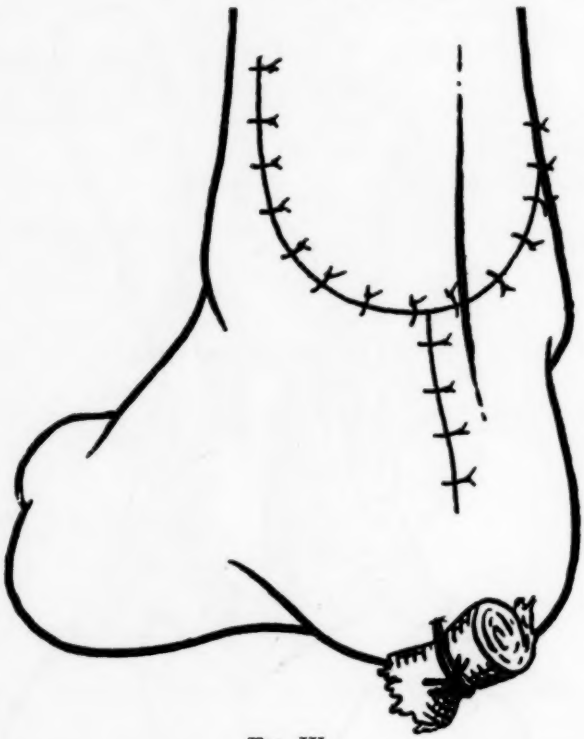

FIG. IV

Operation Completed. The Deformity is Corrected. The Sutures Holding the Deep Tendons in Their Bed Are Tied Together Over a Pad of Gauze under the Heel.

The transplanted tendons are thus fixed in their bed, while further sutures are introduced to fix them to the Tendo Achilles.

A sole splint is then applied to maintain the correction of the cavus deformity, and the foot is encased in plaster of paris in full

equinus for six to eight weeks. Postural and general treatment should be continued for another two to three months.

The result in these cases as regards function is excellent, and has in my experience withstood the test of time.

Case 5. Here we have some power in the anterior tibial muscles, but none in the tendo achilles, and little or none in the posterior tibial muscles. If any power is present in these it is often unequal, and a lateral deformity, usually valgus, is present as well as the calcaneus.

Treatment. The cavus deformity is first corrected by free removal of bone. The wedge removed may include the whole of the scaphoid and the articular surfaces of the astragalus and internal cuneiform bones, as well as most of the cuboid and its articulation with the os calcis.

Then through a posterior incision the cartilaginous surfaces of the astragalus, tibia and fibula are cut away, and a posterior wedge is removed, which includes the subastragaloid joint, and is sufficient to allow the foot to be brought into the straight or slightly equinus position and also to be displaced backwards in relation to the tibia and fibula. It is fixed in this position for eight to twelve weeks.

We thus obtain a short stable foot, which acts mainly as a peg, controlled by the knee joint.

The shortening of the foot in this case is not a disadvantage, and the arthrodesis of the ankle, subastragaloid and medio tarsal joints, gives the stability necessary for function.

All the operations I have described may be completed in one stage.

I am much indebted to Capt. W. H. Ogilvie for kindly preparing the illustrations shown.

TUBERCULIN

Its Use in the Treatment of Bone and Joint Tuberculosis.

BY S. KLEINBERG, M. D., NEW YORK CITY.

The literature on the use of tuberculin for therapeutic purposes is very voluminous. Though tuberculin has been used in the treatment of tuberculosis of glands, kidneys, bones and joints, skin, etc., it has received its widest and most thorough application and test in the treatment of tuberculosis of the lungs. In judging of its value, therefore, we would naturally consult the records of its administration in cases of pulmonary tuberculosis.

Perusal of the more recent articles shows that most of the observers consider tuberculin of great help in pulmonary tuberculosis. Some men believe that tuberculin actually cures pulmonary tuberculosis. Others are convinced that tuberculin, while it may not be curative, is, nevertheless, essential in the immunization and management of tuberculous patients; while still another group of men believe that tuberculin is not a specific or curative, but is an important adjuvant in the treatment, acting as a strong stimulant. Sahli believes that tuberculin is destined to fill as important a place in the fight against tuberculosis, as vaccination does in small-pox. Karl Von Ruck is very enthusiastic about the curative influence of tuberculin. He reports that out of a total of 4,000 cases of pulmonary tuberculosis treated with tuberculin, 49% were cured at the time of discharge from the hospital. Trudeau writes "I believe that, if skillfully used, tuberculin stimulates the defensive resources of the organism, and is a valuable adjunct to treatment in many cases." G. R. Pogue in a review of 167 cases treated with tuberculin, reaches the following conclusions: "1—Valuable aid, 2—Tuberculosis may be arrested by proper treatment, 3—Cases treated with tuberculin show less tendency to recurrence." E. R. Baldwin states that "Tuberculin may work much good in some patients by lessening the sensitiveness to itself." Fremont-Smith is in favor of its use. He concludes that "Tuberculin watchfully employed produces a check in the downward progress, a commencement of the building up." Lawrason Brown is in favor of its use. Lyons treated 100 cases with 72% improvements. Shively is of the opinion that "It is certainly true that in many cases this (the patient's resistance) can be developed and strengthened by immunizing doses of tuberculin."

Other observers, these form the minority, are more conservative in their estimate of the value of tuberculin. Walter C. Klotz in a very convincing article states that the best and the most we may expect of tuberculin is that it acts as "an important adjuvant to the long and expensive hygienic treatment."

Two facts are evident from the literature. First, that tuberculin has been given an extensive trial by many men in the management of pulmonary tuberculosis. Second, that most of the investigators, and among these are men whose opinion bears great weight, believe that tuberculin has a very definite and more or less valuable place in the treatment.

In cases of bone and joint tuberculosis, tuberculin has been used but little, and by only a very few orthopaedists. Dr. John Ridlon some years ago used tuberculin, and concluded that in some cases there was no influence on the disease, while in others there was distinct injury to the patient, and aggravation of the tuberculous process.

Dr. Chas. Ogilvy in a study of tuberculin concludes that "Tuberculin in small does at proper intervals is of undoubted value in the treatment of selected cases of tubercular bone and joint infections."

Nutt and Hastings used tuberculin in a fairly large number of cases of bone and joint tuberculosis. They concluded that "Tuberculin is of decided value in the treatment of tubercular joints. It may be administered during any stage of the disease." These authors cite many of their cases as improved. They interpret the improvement as the direct result of the use of tuberculin. In most of the cases, however, judging from the description, the improvement is not marked, and might very well have occurred without the use of the tuberculin. The period of observation was too short to allow one to judge of any permanent changes. There were several cases of negative results. In general the observations made by these investigators did not, it seemed to me, offer convincing proof of the value of tuberculin.

Thus, the literature taught us that while internists had great faith in the healing influence of tuberculin in pulmonary cases, in surgical or bone and joint cases, the results of the use of tuberculin were not specially encouraging. However, it was also evident that tuberculin had not been given a sufficiently long or extensive trial

in orthopedic cases, and that criticism of the value of tuberculin in such cases would be unfair. Furthermore, the orthopedists had used tuberculin in either single, fairly large doses, or had repeated the same dose at short intervals. Thus they frequently got severe constitutional reactions. In recent years, the belief has grown that for therapeutic purposes tuberculin should be given in increasing doses, and regulated to avoid a reaction. This reactionless method of tuberculin administration attracted my interest as it seemed reasonable, and there was no report in the literature of its application to bone and joint cases. I, therefore, set out to test the value of tuberculin administered to bone and joint cases in increasing doses, and by the reactionless method.

For the proper management and treatment of a case of bone and joint tuberculosis with tuberculin, there are three essential factors. First, a correct diagnosis. Second, a thorough knowledge of the symptoms, course of the disease and likely complications. Third, an accurate knowledge of the dosage of tuberculin and its action.

Correct Diagnosis: It may perhaps be superfluous to direct attention to the importance of a correct diagnosis. Nevertheless, where a medicine is still in the experimental stage, and tuberculin certainly is that, it is especially important that we treat the disease we intend to treat so that our conclusions may be worth recording. I am prompted to emphasize this point from a very striking experience. A case was presented to me as demonstrating the curative effect of tuberculin. The patient was a girl 8 or 9 years old, who was supposed to have had tuberculosis of both hips and was cured by tuberculin. She was extremely well nourished, did not limp, and showed no evidence of any previous abscesses or sinuses. Both hips were slightly limited in abduction, but otherwise normal. There was no shortening, adduction or flexion deformity. There was no sensitiveness of either hip joint. All the motions of the hips except abduction were entirely free and painless. I grew curious and asked for the radiogram taken before treatment was begun. This showed flattening of the femoral head, and broadening of the neck in each hip, radiographic signs that are characteristic of Perthes' Disease. This was not a case of tuberculous hips at all. Under the restrictions incidental to the course of intensive tuberculin treatment, and from the accompanying enforced rest, this patient improved as practically all cases of

Perthes' Disease do with rest. But because of the erroneous diagnosis, this patient was paraded as exemplifying a tuberculin cure.

Course and Complications of Tuberculous Osteitis and Arthritis: Tuberculous disease of bones and joints is a slowly progressive and destructive process. Under favorable hygienic surroundings, and with appropriate orthopaedic treatment, it frequently has remissions. During the quiescent period the lesion gives few, perhaps no subjective symptoms, and the destructive process is at a standstill, with no increase in the objective findings. Such a period of quiescence may last weeks, months or years, when with or without apparent cause there is a relapse, a flaring up of the lesion with marked symptoms. It is practically impossible to decide whether a given tuberculous lesion, except perhaps one that has been completely eradicated by operation, is cured—never to recur. I have a patient 39 years old who has a tuberculous hip which was quiescent for 20 years, and then became active. Dr. Gibney related the instance of a woman who for 50 years had a discharging sinus and no other symptoms of a tuberculous joint. During this long period of years the sinus would open, heal up and reopen at irregular intervals. All of us know of tuberculous patients who are free from symptoms for varying periods, and then show signs of an active disease. All of which goes to prove that a tuberculous patient who shows no symptoms of active disease for a limited time is not necessarily cured. On the contrary, experience teaches us to be skeptical, and to expect that during a moment of diminished resistance or without apparent cause, symptoms will reappear.

The commonest complication of bone and joint tuberculosis is an abscess. An abscess may persist for a long time and be absorbed. It may discharge spontaneously and disappear, or leave a sinus. When artificially evacuated it may disappear or leave a sinus. Most frequently there is a resultant sinus which may last a long time and heal up, or may be closed and discharging at irregular intervals. The closure of a sinus does not perse signify that the underlying causative lesion in the bone or joint is entirely healed or healing. Last but not least, we must not overlook the fact that under orginiary hygienic, conservative and orthpoaedic treatment some tuberculous arthritides heal by fibrous or bony ankylosis.

It is well also at this point to emphasize the fact that a patient

receiving tuberculin visits the physician at least twice a week for many, many months. The parent or guardian and the patient himself are so thoroughly impressed with the gravity of the condition, the importance of treatment, and the necessity for constant watchfulness, that the patient receives unusually good care. Tuberculin treatment requires taking of the patient's temperature about four times a day, and a keen lookout for unusual symptoms indicating a local or constitutional reaction. Any treatment requiring such close observation of the patient inevitably leads to unusual care. As a result of this careful and unusual supervision, the patients eat well, rest sufficiently, seek the fresh air frequently, and in general live a more wholesome and healthful life which is conducive to improvement of the patient and of the tuberculous lesion. We must take this into consideration as it probably accounts for a considerable portion of the improvement. Dr. Whitman has often remarked that every new treatment has some advantages. The physician in charge is enthusiastic, and through him the patient and parents become hopeful. A proper atmosphere for improvement is created, and the patient benefits thereby. Recently I had charge of the orthopaedic treatment of the children at the Neponsit Beach Hospital. These children are all tuberculous. It was very interesting to see the change in the children within a fortnight after their admission to the hospital. With no other change than the administration of plenty of wholesome food, living in the fresh air the major part of the day, and rest, the children who came in dull and pale, without appetite and sickly, became bright, happy, hungry, smiling and rosy cheeked,—all the result of an improved environment.

The above characteristics of bone and joint tuberculosis have been reviewed so that we may keep them constantly in mind in discussing tuberculin therapy. When in the course of tuberculin therapy, symptoms subside, we must carefully weigh the evidence and decide whether the improvement is the direct result of the specific treatment, a likely occurrence in the course of the disease, or merely incidental to intensive care.

Dosage of Tuberculin.—It goes without argument that he who intends to use tuberculin must acquaint himself thoroughly with its action. Tuberculin may be very toxic, and if unwisely or improperly administered may do great harm, even to the point of killing the patient, so great care must be exercised in its usage.

In order to acquaint myself thoroughly with the dosage and pharmacology of tuberculin, I spent many months at the tuberculin therapy clinic of the New York Polyclinic Hospital where I studied the theory and practice of tuberculin therapy, and learned the method of administration of tuberculin in increasing doses. The method of dilutions and dosage, by the way, is extremely simple and is easy to apply. The great and only serious danger comes from indifference in preparing the various dilutions, so that a much larger dose of the drug shall not be given than is intended.

We all realize the imperative need of a specific in tuberculosis of bones and joints. In adults we frequently are able to rid the joint of the tuberculous infection by thorough operative removal of the diseased tissue. In children, and it is among these that we see most of the cases, radical treatment is contra indicated, and a medical cure would indeed be a blessing and most welcome.

In 1914 the writer was very much impressed with the large number of bone and joint cases which were being treated with tuberculin at the Polyclinic Hospital. Dr. Bonime, the chief of the tuberculin department, spoke very enthusiastically in favor of tuberculin. He insisted that the failures from tuberculin treatment in the past were due to improper dosage, and that with the method of gradually increased doses "we may consider the curability of bone and joint tuberculosis as complete."

Theoretically, it was argued that the injection subcutaneously of increasing doses, beginning with small innocuous quantities, would cause the manufacture in the blood of substances that would destroy or lysinize the tubercle bacilli. If the tuberculin is given in increasing and properly regulated amounts, not only would the tubercle bacilli gradually be killed off, but the patient would become resistant to tuberculous invasion through loss of hypersusceptibility to the tubercle bacilli. Thus both the patient and the local process would be cured. The theory sounded reasonable and attractive. In the course of my observations at the Polyclinic Hospital, I saw many patients who at first gave local and constitutional reactions from very small amounts of highly diluted tuberculin, and finally assimilated fairly large doses of pure tuberculin, without any reaction. It was argued that if these patients can take by subcutaneous injection pure tuberculin without reaction, they must have acquired a tolerance for, and an immunity to tubercle bacilli, and that they were therefore cured of their tuber-

culosis. The weak point in this argument will become apparent later.

However plausible the theory sounds, my experience with the many patients I observed at the Polyclinic Hospital was not convincing, for I did not see a single case of bone and joint tuberculosis cured. Since, however, many of the cases had insufficient orthopaedic treatment, I decided that it would be wiser and fairer to take a series of cases, and besides giving them tuberculin apply appropriate orthopaedic treatment. My series included a few private patients and the rest from the services of Drs. Gibney and Whitman at the Hospital for Ruptured and Crippled. I was particular to take the cases as they came along, the mild with the severe, instead of selecting any one type. My series included cases of tuberculosis of the spine, hip, knee, ankle, shoulder and elbow joints. Moreover, many of these patients had been under observation for some time before, so that we had knowledge of the previous course and were in a position to adjudge any changes, and to determine if they were the result of the introduction of tuberculin. My observations lasted over a period of two years, and while this length of time in a consideration of tuberculous joints is not sufficient to permit of a final opinion, yet the experiences were such as to warrant definite conclusions.

In many instances where there were secondary infections, as from a discharging abscess, antogenous vaccines were employed. The injection of Beck's bismuth paste into sinuses was also frequently employed. We will exclude discussion of the use of vaccines and bismuth as these substances evidently cannot alter the real influence of tuberculin.

At the outset it is well to establish a guide, some standard whereby we can gauge the results of treatment. We must decide what changes will indicate improvement or recession of the tuberculous process. The following changes would indicate improvement:

1. Disappearance of muscle spasm.
2. Disappearance or diminution of joint or bone sensitiveness.
3. Reduction of swelling.
4. Resorption of abscesses.
5. Healing of sinuses.

6. Healing of bone as shown by X-ray through
   A. Increased bone density
   B. Ankylosis
   C. Irregular outline of bone becomes regular.

The last is undoubtedly the most convincing proof of improvement. It is well again to emphasize that (1) improvement of the patient's general condition is not an evidence of the effectiveness of tuberculin, or that the tuberculous lesion is healing, for, general improvement is often obtained as above mentioned, by hygienic measures, forced feeding, sleeping in the open air, etc., and (2) Patients with tuberculous joints often look unusually well while the destructive process is advancing.

Report of Cases.

CHARLES W.—Four years old. (Dr. Whitman's Clinic.)

Tuberculous disease of the dorsal spine and right ankle. Duration of the disease when first seen was one and one-half years. Wears a plaster of Paris Jacket and a stiff ankle brace. Disease of the spine not progressing. Right ankle and leg markedly swollen; numerous sinuses; extensive destruction of the tibio-astragular point. Runs an afternoon temperature of 99.5°F. General condition fair; patient pale. Patient lives in the country under excellent hygienic surroundings. Tuberculin therapy begun April, 1916, with 10/100 cc of the third dilution. Tuberculin treatment continued, and completed June, 1918. Autogenous vaccine used. Sinuses injected with Bismuth paste.

Result: General condition unchanged; sinuses still discharging. Swelling of the ankle and leg just the same. Destruction of bone, as judged by numerous roentgenograms taken during the course of treatment, just as extensive. The tuberculin did no harm, but also caused no improvement or healing.

Result negative.

STELLA P.—Nine Years Old. (Dr. Gibney's Service.)

Entered Hospital for Ruptured and Crippled March 19, 1915, for tuberculous disease of the left hip complicated by several abscesses. Condition had been in existence for about one year. During June, 1915, another abscess developed and was evacuated. Tuberculin treatment was begun September 28, 1915. A full course

was given, that is, having begun with minute doses, these were increased so that finally in 1916 the patient was able to receive pure tuberculin as well as the bacillary emulsion without any reaction. In addition the patient received autogenous vaccines, and the sinuses, of which she had several, were injected with Bismuth paste. The patient had one reaction during the entire course of the treatment. When the patient was about half way along in the treatment, she developed another abscess. At the end of the treatment the patient had evidently not been improved, though at this time she was no worse. The local process in the hip was certainly not healed, as evidenced by the persistence of the clinical and X-ray findings. The abscesses and sinuses did not heal; in fact a new abscess appeared. Her general condition was slightly improved—but she had been kept in the open air most of the time and was receiving unusual care, and an extra amount of food. Subsequently, in April, 1917, her condition was somewhat worse; the discharge from the sinuses was more profuse than ever, and both the liver and spleen were palpably enlarged. This patient was certainly not helped by the tuberculin.

Result negative.

ISIDORE S.—Ten years old. (Dr. Gibney's Service.)

Tuberculous right hip. Several complicating sinuses. Flexion deformity of the hip. Tuberculin treatment began in the fall of 1915. A full course of treatment lasting over one year was given. In July, 1916, while he was getting tuberculin in the first dilution, he developed a fresh abscess. It is interesting to note that this patient like many others developed an abscess during treatment. When a patient has progressed from the third or fourth dilution to the first dilution, if the theory of the use of tuberculin is correct, the patient has developed a certain degree of immunity. Yet this boy developed an abscess while receiving the first dilution of tuberculin. In June, 1916, when he was getting pure tuberculin, he developed another abscess. Old sinuses re-opened in July, 1916.

Result: This patient was in no ways harmed by the tuberculin. Yet there was no improvement, for there was no sign of healing of the diseased hip, and the sinuses discharged as freely and as profusely as ever.

FRED K.—Nine years old.

Developed tuberculous disease of the left hip at the age of three years. The disease was progressive. At the time of my first examination on April 26, 1916, he was in good general condition. There was one inch of shortening of the left limb which was in an attitude of flexion, adduction and outward rotation. There were numerous scars about the hip from previous abscesses and sinuses, none of which were discharging. The X-ray picture showed destruction of the femoral head and marked excavation of the acetabulum.

Tuberculin treatment was begun May 17, 1916, with the injection of o.lo cc of the third dilution and was completed January 13, 1917, having received a full course of tuberculin and bacillary emulsion. On five different occasions this patient gave a local and constitutional reaction to the tuberculin.

Two months after tuberculin treatment was begun, when he was receiving the second dilution, an abscess appeared on the front of the thigh; this left a sinus which discharged for about 15 months. At the end of the treatment the boy was in exactly the same condition as before the treatment except for the discharging sinus. X-ray pictures showed no increase of the destructive process. There was, however, no evidence of healing. The appearance of the abscess during the treatment may have been the result of the treatment—an exacerbation of the old focus, since theoretically tuberculin causes hyperaemia at the site of the disease. However, it is perfectly possible that this abscess might have appeared without the use of tuberculin. So that, giving the tuberculin the benefit of the doubt, the most that we can say for it in this particular case, is that it did no harm. It certainly did no good.

REUBEN R.—Twenty-one years old.

Came under my care February, 1916. He complained of pain and swelling of the left ankle. The diagnosis at first was in doubt because of a negative X-ray. Wasserman test was negative. A subcutaneous tuberculin test was positive as he developed local, constitutional and focal reactions. The focal reaction was the diagnostic feature; the ankle became more swollen, more painful and more sensitive. He was given a full course of tuberculin, including bacillary emulsion. At the completion of the tuberculin treatment the condition of the ankle was the same as that prior to the

tuberculin therapy, that is, the swelling, sensitiveness and limitation of motion of the ankle were the same. The disease continued until January 8, 1918, when I operated on the patient and removed the diseased tissue from the adjacent surfaces of the astragulus and os calcis.

This man came under my care six months after the apparent onset of the disease, so that this was an early case, and theoretically the right choice for tuberculin therapy. Yet even here the tuberculin was of no value, as the disease continued during and after a full course of tuberculin.

MR. S.—Fifty years old.

This patient was not under my personal supervision. I saw him in consultation and followed the course of his illness over a long period.

Extensive tuberculosis disease of one knee. The knee was deformed in flexion of about 90°. There were numerous sinuses about the joint, all discharging very profusely. This man was treated for many, many months with tuberculin and mixed vaccine without any benefit. Finally when the disease was extremely far advanced, and when the ulceration about the knee was so extensive that no kind of efficient support was possible, an excision was resorted to; later the limb was amputated and the patient died. In such a case it seems to me very much and valuable time was lost by adhering to tuberculin and conservative treatment, and neglecting operative treatment. During the months of conservative or rather expectant treatment, the deformity of the knee increased, the contraction of the tissues became more confirmed, and correction impossible. Moreover the secondary infection and ulcerations precluded successful operation. The time to have operated was as soon as the diagnosis of tuberculous arthritis was beyond doubt. This is the only method that offers a favorable prognosis.

In this case the tuberculin was evidently of no value. Moreover faith in its curing powers led to unnecessary delay and very poor judgment. It is in connection with such a case as this that we doubt the advice that tuberculin cures all cases of tuberculous bone and joint disease.

MORRIS F.—Twenty-one years old. Aug. 20, 1915.

This patient was seen one year ago with extensive disease of the left shoulder and abscess formation. He was advised an

excision of the diseased bone. Instead he received tuberculin treatment. The abscess was opened and is still discharging. The patient is in fair condition. He has had several acute exacerbations, but at present while there is some joint sensitiveness and muscle spasm, fair healing of the bone has evidently taken place. The boy is certainly not through with treatment—tuberculin or orthopaedic treatment. There can be no doubt that he is in better condition than he was a year ago; yet despite a full course of tuberculin, he is not done with treatment—nor will he be for some time to come. The question arises as to whether he would after all not have been better off with an operative removal of the focus, as there probably is a latent focus of tuberculous tissue in the apparently healed section of bone.

There is also this important question to answer: Could this patient perhaps have done just as well as he did with aspiration of the abscess, and ordinary fixation of the joint? He probably would have, and in addition the arm would have been supported in moderate abduction and been more useful than it is now, having been held at the side for one whole year.

BERNARD K.—Six years old.

I saw this patient for the first time on Dec. 9, 1917. He appears to me to be of special interest because the course of his disease leaves no room for doubt about the action of tuberculin. This patient developed tuberculous disease of the right hip joint. He consulted a prominent orthopaedic surgeon who diagnosed the condition, applied an efficient traction hip brace, and gave the boy a full course of tuberculin treatment including the bacillary emulsion. There is no doubt about the proper dosage, etc., of the tuberculin as this particular surgeon had made a special study of the administration of it and was acquainted with all its details. The boy came under observation in 1915. At that time he showed a beginning lesion in the femoral head. Numerous X-rays were taken at frequent intervals between 1915 and November, 1917, during which time he had completed his tuberculin treatment. The lesion gradually progressed, each successive X-ray showing increased bone destruction, and finally 1½ inches of shortening of the limb. The last X-ray shows marked erosion and enlargement of the acetabulum, marked erosion of the femoral head and depression of the femoral neck so that there is a pathological coxa

vara. Tuberculin was of no value whatever in this case for the destruction continued as if it had not been given at all.

AARON L.—Seven years old. (Author's Clinic, Lebanon Hospital)

Came under my observation in September, 1916. At this time he showed symptoms of irritation of the left hip joint and moderate flexion deformity. X-ray examination was negative. The deformity was corrected and the hip encased in a Plaster of Paris Spica. The sensitiveness of the hip continued, and in June, 1917, an X-ray picture showed slight erosion and enlargement of the acetabulum and slight rarefaction of the head and neck of the femur. Wasserman test was negative. A subcutaneous tuberculin test was positive. There was no source or focus of infection discoverable of which the hip involvement might be a secondary or metastatic lesion. The clinical and X-ray findings plus the positive tuberculin test made the diagnosis of tuberculous hip undoubted. The boy was given a full course of tuberculin and bacillary emulsion. At the end of this time, in April, 1918, another X-ray examination was made of the hip. This picture showed complete destruction of the head of the femur, partial destruction of the neck, and an upward displacement of the great trochanter. In this, as in the last case the conclusion is evident. Destruction of bone continued despite the use of tuberculin—an evident tuberculin failure.

MAGGIE F. (Services of Drs. Gibney and Whitman). Ten years old.

Entered Hospital for Ruptured and Crippled on Aug. 24, 1914. Developed tuberculosis of the spine and left hip 1½ years previously. Examination by Dr. Whitman on Aug. 27, 1914, showed active disease of the spine (11 and 12 dorsal) and left hip, and disease of both elbows apparently in a quiescent or latent stage. Between August, 1914, and September, 1915, patient developed numerous abscesses about the left hip; these ruptured spontaneously or were opened and continued to drain. There were also several sinuses about the elbows. The patient gradually improved so that on Sept. 23, 1915, the general condition was good. The sinuses about the elbows were all healed. There were, however, several sinuses about the left hip. The patient was running a slight temperature and the impression one gained was that this was the kind of a case in which it was difficult to predict the likely course; she might go on to further improvement, or might get very much

worse. The spine and three large joints were involved, the patient was running a temperature, and altogether it was exactly the type of patient for whom we needed additional help. This patient was an Italian, and having been warned by Dr. Bonime that in Italians and Negroes we must begin with small doses of tuberculin, this patient was started on the 5th dilution of tuberculin on Sept. 28, 1915. On Dec. 2, 1915, it was noted that patient had thus far tolerated the tuberculin well. She was in fair condition. There were no sinuses about the elbows and only two sinuses about the hip. It might here be mentioned that this patient, like all others, was receiving an extra amount of food, was kept on the porch all day long, and in other ways received an extra amount of attention.

On Jan. 6, 1916, this patient received 0.40 cc of the third dilution of tuberculin, this being the proper dose at this time. She developed a temperature of 104 and malaise. There was a local reaction. The left elbow became markedly swollen and acutely inflamed. A great amount of pus developed, and this had to be liberated on both the inner and outer sides of the elbow joints, leaving two sinuses which continued to discharge. Soon afterwards she developed an iritis in the right eye, and the discharge from the sinuses about the left hip became profuse. Her general condition became very poor. I resorted to the use of autogenous vaccine, employed bismuth paste, reduced the dosage of tuberculin very materially, but could not induce any favorable change. The patient continued on the down grade. In August, 1916, the patient, in spite of extra attention and a stay in the country, was evidently worse. The sinuses were discharging very profusely. The liver and spleen were much enlarged and the patient looked very poorly. She then disappeared from observation, and some months later I heard that she had died.

In reviewing this case we are forced to conclude that tuberculin was mainly, if not entirely, responsible for the aggravation of the condition. It may be argued that this was an unfavorable case; but we have no means of judging which is and which is not an appropriate case for tuberculin treatment. Every dose of tuberculin causes a focal reaction—that is, an acute aggravation of the tuberculous lesion. Under ordinary circumstances this reaction is mild and causes no harm. But in the hyper sensitive

individual this reaction may, as it did in this instance, cause an uncontrollably severe exaccerbation leading to disastrous results.

The treatment in this case might not have resulted so poorly, had it been possible to always keep within the limit of the patient's tolerance. It is however impossible to always avoid a constitutional and focal reaction. In fact Dr. Bonime states (p. 53) that "The only index to the measure of tolerance in every individual is a constitutional reaction, hence a constitutional reaction is desirable in every case."

Dr. Bonime recognises the occasional occurrence of very severe reactions, for he states that "Only long experience and expert judgment can bring about a fair amount of accuracy in the choice of the patient—a fact that stands out most prominently against the wider adoption of tuberculin therapy." In this case, then, the tuberculin aggravated the disease.

DOMINICK M.—Nine years old. (Services of Drs. Gibney and Whitman).

Patient was seen by me in August, 1915. He had tuberculous disease of the right hip joint with numerous sinuses. He entered the hospital in May, 1915, in very poor condition. Examination shows that the boy had very extensive destruction of the right hip joint. There were numerous sinuses and ulcers extending along the right thigh so that the entire thigh was an open wound from the hip to the knee. There was a very profuse discharge of foul smelling pus. The patient was pale, very weak and helpless. He lay in a wheel cart, the affected limb being so sensitive that he was unable to bear any weight on it, or permit any manipulation. He ran a daily temperature ranging from about 100 or 101° in the morning to 103 or 104° in the afternoon. He was given tuberculin, autogenous vaccine and the sinuses were injected with a mixture of Zinc Oxide, Balsam of Peru and Vaseline. This boy improved slowly, but very markedly. His temperature subsided entirely; most of the sinuses closed up, and the sensitiveness of the joint diminished. In December, 1916, this boy was in good condition. His temperature was normal, he had gained in weight, his appetite was good, and he looked bright. There were only a few sinuses about the hip discharging a moderate amount of pus, and he was walking about. This is the only case in my experience which showed so remarkable a change. But even in this case it

is impossible to say that the tuberculin alone was responsible for the improvement, since we used an autogenous vaccine.

MARY S.—Ten years old. (Dr. Whitman's Service.)

Tuberculous right ankle; no sinuses. September, 1915. Ankle is swollen and painful. Leg and foot encased in plaster. Patient uses crutches. Tuberculin treatment began Sept. 25, 1915, with 0.10 cc of the IV dilution. Treatment completed June, 1916. She improved gradually so that she was able to discard crutches and plaster. The sensitiveness of the joint disappeared and the function of the ankle improved considerably. This patient was evidently benefited by the tuberculin. Six months after completion of the tuberculin therapy, the patient suffered a relapse. There have been several relapses—temporary swelling and sensitiveness of the ankle—during the last two years. We may say of this case that tuberculin was apparently helpful, the disease retrogressed, the patient was improved generally, but the disease was not cured as there have been relapses.

HENRY S.—Seven years old. (Dr. Whitman's Service.)

Tuberculous left elbow. Has had the disease for about two years. There are several discharging sinuses about the elbow. X-ray taken May 5, 1915, shows marked involvement of the ulna. Tuberculin treatment was begun October 14, 1914, with 0.10 of IV dilution. The patient received a full course of Old Tuberculin and Bacillary Emulsion. He received the last dose of the latter preparation November 18, 1916. In addition he received an autogenous vaccine of staphy-lococcus albus. He had several mild reactions. This patient improved definitely. The sinuses healed; the joint sensitiveness diminished materially; there appeared returning motion in the joint, and an X-ray taken July 18, 1917, showed increased bone formation in the area previously softened by disease. Improvement was evident in this case, and although it was not particularly severe to begin with, nevertheless the change was prompt and definite, and we must attribute the good result to the tuberculin. This patient continued in good condition for some time. He was seen again on May 2, 1919, and the joint was found swollen and painful—that is, he had a relapse.

I have used tuberculin in at least eight or ten cases more. These are not reported in detail because none of them received a

full course of treatment. This much, however, must be said, that there was apparently no benefit derived from its use.

Discussion

Curability of Bone and Joint Tuberculosis by Tuberculin.

The most important and evident conclusion from a study of our cases is that none were cured by the administration of tuberculin. Only three cases of the entire series were improved; two of these later developed a relapse. One case was manifestly aggravated. In all the others the result was negative, we could see no influence of the tuberculin for better or worse. I desire to emphasize the fact that this conclusion is all the more important, because it agrees entirely with the results of my observation in a much larger number of cases seen at the Polyclinic Hospital. I have myself treated very many more than are here reported, both at the Hospital for Ruptured and Crippled, and at the Lebanon Hospital, but I do not report them because treatment for one reason or another was not completed.

Many observers believe that tuberculin is a tonic for tuberculous individuals. Perhaps that is so. Even in our series we cannot deny that even in the negative cases tuberculin may have acted as a tonic or stimulant. If it did, its influence was not evident, and certainly inconsequental. General improvement, evidence of supposed tonic influence, is, however, more than likely due to unusual care these patients receive.

Our experience differs from that of Dr. Bonime, who in speaking of the use of tuberculin in bone and joint cases says "I cannot recall a single case in a period of seven years that has proven an out-and-out failure." In reading Bonime's book on tuberculin therapy, one gets the impression that tuberculosis need no longer be feared, and that the tuberculous can all be cured by the use of tuberculin. From a fairly extensive experience with my own cases and many others, I cannot recall a single case of an out-and-out success.

And as a matter of fact when we analyse the nature of tuberculin, and study its pharmacology, we do not expect that it should *cure* tuberculosis. It is pretty well agreed upon that tuberculin is a solution containing *some* of the toxins of the tubercle bacilli, and

certainly *not all* of the toxins. At best, therefore, as emphasized by Klotz, tuberculin can produce a tolerance to only a limited variety of the tuberculous toxins. Tuberculin produces a tolerance for tuberculin, and not for the tubercle bacilli or all of their toxins. So that when a patient has been brought to a point where he can assimilate tuberculin without re-action, he is not cured, he is not immunized against tuberculous infection, he has simply acquired a tolerance for certain of the by-products or toxins of the tubercle bacilli.

It is conceivable that in a limited number of cases the toxins producing the disease are identical with those contained in the tuberculin, and such cases may actually be cured by the use of tuberculin. Such cases must be rare and are accidental, and as we have no means of knowing the exact toxins contained in the tuberculin, selection of cases is impossible. In those cases in which tonic effect and improvement were noted, it may be that the tuberculin acted by immunizing against certain of the toxins of the disease, and in that way was useful. But in the majority of cases it certainly does not immunize against enough of the toxins to act as a cure. Shively concludes from his experience that in selected cases tuberculin has a stimulating effect, but that "tuberculin in itself has no curative properties."

In his book on Tuberculin, Bonime teaches that a patient is cured of his disease when he can tolerate pure tuberculin. This is suggested in the following remark "and lastly, but not the least, is the fact that in the case of a patient cured by tuberculin, the orthopaedist will be able to decide the exact time for the removal of the various appliances." He evidently assumes in this sentence as in many others in his book, that when a patient can take pure tuberculin without re-action, he is cured. This is a fallacious assumption as proven by my own cases, many of which were brought to a point of taking pure tuberculin without re-action, but in whom the disease was either continuing in its chronic course, or was progressing.

My experience in this regard is borne out by Trudeau and Klotz. The former observer states "It cannot be said, that the amount of good a patient derives from tuberculin treatment is always in direct ratio to the size of the dose of toxin he can be brought to tolerate." Klotz states that "Tuberculin cannot and

does not confer immunity against infection with tubercle bacilli either as a preventative measure or in the course of disease."

That tuberculin does not immunize against the destructive influence of the disease is shown especially in two of my cases, F. K. and A. L. These boys had closed lesions. They were brought to a point where each was able to take pure tuberculin subcutaneously without re-action. Yet, despite the supposed immunization, the disease progressed and the bone destruction continued.

The disappearance of an abscess does not in itself decide the cure of the underlying disease. On the other hand, the development of an abscess during the administration of tuberculin, and especially when the patient is taking almost pure tuberculin, certainly indicates that tuberculin does not develop immunity or cure. Several of my cases developed abscesses some time after the tuberculin therapy was going on, and while the patient was tolerating number two or even number one dilution of tuberculin.

There is another phase of tuberculin therapy that must not be overlooked. This may be divided into the immediate and remote effects. Among the immediate effects must be considered the toxic influence on the patient and the disease. There is no doubt that tuberculin is a poison and an overdose may be very disastrous. Klotz states "The essential effect of tuberculin is the focal re-action or the inflammatory changes that take place in or about all existing tuberculous foci." "These changes consist in congestion or, if severe enough, necrosis and softening." A large dose may cause extension of the tuberculous process. Trudeau states "Clinical experience has pretty definitely established by this time that marked re-actions, whether general or focal, are not beneficial, and may be dangerous by their baneful effect on the general condition of the patient and also by producing aggravation and extension of the local lesion." M. S. Cohen states that a dose in excess of the exact amount required frequently proves disastrous, and has even hastened death. Baldwin states that while tuberculin may do some good that "It may aggravate the disease." In one of my cases the disease was very distinctly made worse, and the patient ultimately died. Thus tuberculin may prove very harmful, and its administration must be accompanied by careful, close, and continuous observation.

Remote effects: Among these must be considered the results of the combination of over confidence in the value of tuberculin,

and oversight of the usual orthopaedic treatment. Such ill results were shown in two of our cases. One was the adult with tuberculosis of the shoulder. Inefficient splinting resulted in ankylosis of the shoulder with the arm at the side of the chest—a poor functional result, a condition which could have been avoided by efficient splinting. The other was the case of the adult with tuberculosis of the knee. So much faith was placed in the value of tuberculin that support of the knee was neglected, with the result that the knee became contracted to 90 degrees. Secondly, so much time was wasted with the tuberculin, that the opportunity of cure by excision of the knee joint and the diseased tissue was lost.

I would further call attention to the fact that inasmuch as the ability of the patient to tolerate pure tuberculin does not indicate a cure, removal of an appliance is not necessarily indicated when tolerance for tuberculin has been established. Speaking of the removal of apparatus, Bonime says that "This necessarily always had to be a matter of guess, as the orthopaedist was never certain whether the joint is merely quiescent or cured, and therefore frequently insisted on prolonging the wearing of these appliances for a number of years, even though the patient seemed entirely well. With the danger of a relighting of the infection removed—the element of guess is eliminated—and both the patient and the orthopaedist need not fear the removal of the appliances." The same author continues: "The tuberculin will, moreover, act as a guide to the limitation of orthopaedic treatment—it will be unnecessary to order the cumbersome appliances to be worn year after year, for tuberculin will do away with the element of "guess," which has to be so prominent in orthopaedics. For with the conviction of having checked the infection and overcome the susceptibility, the length of time for orthopaedic application can be gauged more accurately.

Firstly the orthopaedist is not quite in such a desperate circumstance that he must "guess" about his treatment. Secondly, when a tuberculous individual can take pure tuberculin, that does not mean cure of the joint; it does not mean that the tuberculous infection has been checked—and such an assumption would be frequently hazardous and disastrous to the joint.

It would be well if we knew when the danger of a relighting of the infection was removed. It certainly is not removed when the patient has been brought to the point where he takes pure

tuberculin, for we know that relapses do occur after full tolerance for tuberculin has been established. To follow Bonime's advice would work great mischief. If a splint is removed just because pure tuberculin is tolerated, and without proper regard for the condition of the affected joint and limb, other possible ill effects, such as increased bone destruction, increase of deformity, aggravation of symptoms, etc., may be imagined.

CONCLUSIONS

1. Tuberculin does not cure tuberculosis of bones and joints.

2. In the majority of cases, tuberculin therapy causes no noticeable beneficial influence over the bone or joint lesion.

3. In a small percent of the cases there is improvement of the lesion.

4. In some cases there may be distinct aggravation of the disease.

5. New abscesses may appear during and after completion of the tuberculin treatment.

6. Relapses occur after apparent improvement.

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DISABILITY FOLLOWING INJURIES TO THE BACK IN INDUSTRIAL ACCIDENTS

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(Continued from November Journal)

CLASS I.

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability	Diagnosis	Treatment
M	55	Plasterer	Fell 27 ft.	3 months	Back contusion; question of arthritis	Adequate.
M	38	Teamster	Thrown from team	6 months still disabled	Contusion and back strain	Inadequate.
M	38	Roofer	Fell 35 ft.	8 months still disabled	Contusion back	Inadequate.
M	?	Laborer	Fell 4 ft.	1 month	Contusion back	Inadequate.
M	46	Laborer	Fell on back	1 month	Contusion back	Inadequate—Returned to work after accident; has no trouble with back. Makes larger wages, and has worn no apparatus.
M	23	Laborer	Fell 10 ft.	6 months still disabled	Contusion back	Inadequate.
F	35	Chambermaid	Fell down stairs	3 months	Contusion back	Inadequate—No work since accident July, 1916, to February, 1918; still has backache.
M	24	Laborer	Fell 24 ft.	6 months	Contusion	Adequate.
M	40	Laborer	Fell 18 ft.	8 months	Fractured astragalus Contusion back	Inadequate—February 13, 1918, three years after accident still backache and trouble with foot. Still unable to work.
M	21	Carpenter	Fell 18 ft.	3 months	Contusion back	Inadequate.
M	41	Laborer	Fell 6 ft.	1 month	Back strain	Inadequate—Still incapacitated.
M	40	Laborer	Fell 60 ft.	6 months	Contusion back; fractured right leg left knee	Adequate—Still incapacitated.
M	54	Laborer	Fell 3 ft.	3 months	Arthritic spine; contusion back	Inadequate—Still incapacitated.

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability.	Diagnosis	Treatment
F	50	Shoemaker	Fell 7 ft.	7 months	Contusion back	Inadequate—Still partially incapacitated.
M	34	Laborer	Fell 4 ft.	1 month	Contusion back	Inadequate—No disability
M	39	Carpenter	Fell 10 ft.	28 months	Contusion back	Adequate—No disability.
M	46	Laborer	Fell 10 ft.	4 months	Contusion back	Inadequate—Still partially incapacitated.
M	42	Teamster	Fell 6 ft.	13 months	Spondylolisthesis	Adequate—Still disabled.
M	52	Laborer	Fell 18 ft.	1 month	Contusion back; arthritis	Adequate—Still disabled from arthritis.
F	36	Factory	Fell 3 ft.	1 month	Contusion back	Adequate—No disability.
F	30	None	Fell 3 ft.	2 months	Contusion back	Adequate—No disability.
F	35	Factory	Fell 3 ft.	5 months	Contusion back	Adequate—No disability; back at work.
F	21	Factory	Fell down stairs	3 months	Contusion back	Adequate—No disability.
M	28	Laborer	Fell 10 ft.	26 months	Arthritis; contusion back	Adequate—Still disabled—arthritis.
M	23	Laborer	Fell 12 ft.	1 month	Contusion back	Adequate—Well.
M	70	Carpenter	Fell 12 ft.	6 months	Arthritis; contusion back	Inadequate—Still disabled—Hypertrophic arthritis.
M	38	Laborer	Fell 20 ft.	32 months	Contusion and back strain	None—Been working off and on. Back still a cause of disability.
M	37	Laborer	Fell 6 ft.	1 month	Contusion	Adequate.
M	40	Laborer	Fell 3 ft.	2 months	Contusion	Inadequate—No longer disabled.
M	30	Laborer	Fell 30 ft.	3 months	Contusion	None—No longer disabled.
M	30	Painter	Fell 38 ft.	1 month	Contusion back. Broken ribs	Adequate—Still slightly disabled.
M	47	Baker	Fell 16 ft.	4 months	Contusion back	Adequate—No disability.
M	46	Painter	Fell 6 ft.	8 months	Cardio-renal; contusion back	Adequate—Still disabled but not on account of accident.
M	48	Laborer	Fell 8 ft.	6 months	Contusion back	Inadequate—Still disabled.
F	38	Factory	Fell 10 ft.	7 months	Contusion back	Adequate—No disability.
F	42	Factory	Fell in elevator 5 ft.	3 months	Back strain	Inadequate—Still disabled.
F	41	Barber	Fell 3 ft.	13 months	Back strain	Inadequate—Still partially disabled with backache.

Average Period of Disability in this series 6.3 months.

37 cases { Treatment: { Adequate 17—average period of disability 6.8 months
Inadequate 18—average period of disability 4.5 months
None 2—average period of disability 17+ months

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability.	Diagnosis	Treatment
M	55	Painter	Fell 22 ft.	18 months	Fractured odontoid Fractured wrist	Inadequate—Never wore apparatus. Still disabled, and a stiff neck. Bed for 7 weeks.
M	52	Rigger	Fell 15 ft.	40 months	Fractured 12th dorsal and 1st lumbar. Fractured shoulder	Practically none—Had on frame about 6 weeks, since then none. Still disabled.
M	40	Roofer	Fell 25 ft.	16 months	Partial dislocation. Question of arthritis	Adequate—Stiff neck. Partially disabled.
M	40	Laborer	Fell 15 ft.	17 months	1st and 2nd lumbar vertebra. Fractured wrist	Adequate—Still partially permanently disabled. Wears a back brace.
M	48	Carpenter	Fell 45 ft.	5 months	Fractured 1st and 4th lumbar	None at first—One year later gave up brace and went to work. Diagnosis not made for 5 months.
M	43	Carpenter	Fell 30 ft.	5 months	Fractured wrist and 1st lumbar	None—After four weeks, condition of back was diagnosed and treated. Still disabled.
M	28	Laborer	Fell 27 ft.	4 months	Fractured ankle, lamina and 1st lumbar	None for back—Kyphos. Back weak but incapacitated because of foot condition.
M	22	Electrician	Fell 40 ft.	8 months	Fractured spine; crush cord. Fractured left leg	Wore a jacket 6 weeks—no further treatment.
M	44	Mason	Fell 50 ft.	7 months	Fractured 9th Dorsal; 11th, 12th Dorsal, and 1st lumbar	Adequate—Permanent disability. Partial paralysis of legs.
M	30	Laborer	Fell 53 ft.	14 months	Fractured ankle, 2nd lumbar	Adequate—Wearing leather jacket. No paralysis. Partial disability .
M	44	Butcher	Fell 15 ft.	39 months	Fractured 2nd and 3rd lumbar	None—Back strapped for 5 weeks—Kyphos. Has had no treatment. Partially disabled. Does light work on a farm.
M	40	Roofer	Fell 30 ft.	10 months 24 months	Fractured 1st lumbar Fractured wrist	None—No X-ray of back for 10 months. No treatment for back. Has worn no apparatus. Partially disabled.
M	45	Laborer	Fell 40 ft.	9 months	Fractured 1st lumbar	Inadequate—Fracture not recognized. Getting osteopathy for a lame back.
M	45	Iron worker	Fell 33 ft.	2 months	Fractured 12th dorsal	None—Back strapped once—Kyphos. Partially disabled.

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability.	Diagnosis	Treatment
M	56	Laborer	Fell 15 ft.	15 months	Fractured 3rd lumbar	None—In a Hospital after accident and back strapped. Massage and exercises since.
M	38	Plasterer	Fell 40 ft.	14 months	Fractured 12th dorsal, 1st lumbar	None—In bed in a Hospital 30 days. Has done no work. Still has pain in back.
M	42	Plasterer	Fell 10 ft.	5 months	Fractured 1st lumbar	None—In bed at home 7 weeks; been working off and on. Back occasionally lame; wears no brace.
M	39	Plasterer	Fell 12 ft.	12 months	Fractured 12th dorsal and 1st lumbar	Adequate—Jacket and back brace. Still unable to work—Kyphos.
M	42	Laborer	Fell 25 ft.	16 months	Fractured 2nd cervical	Adequate—Stiff neck. Traumatic neurosis. Thinks he is unable to work.
M	39	Laborer	Fell 17 ft.	18 months	Fractured first lumbar	Adequate—Kyphos—no work since accident. Constant backache. Wears a back brace.
M	18	Laborer	Fell 20 ft.	37 months	Fractured 11th and 12th dorsal, 1st and 2nd lumbar	Adequate—No arthritis symptoms; wearing back brace; has had jacket. Still partially disabled.
M	53	Teamster	Fell 15 ft.	32 months	Fractured 1st lumbar. Hypertrophic arthritis	Inadequate—Kyphos. Marked arthritis of spine. No work since accident. Wearing a 6-inch belt.
M	33	Laborer	Fell 54 ft.	53 months	Fractured 11th dorsal	Inadequate—No cast until 2 years after accident. Kyphos. Still disabled except for light work.
M	31	Laborer	Fell 70 ft.	14 months	Fractured 2nd and 3rd lumbar. Fractured leg	None—Went home from Hospital with leg in a cast. Nothing done for back until the end of a year. Now wears a back brace. Permanent disability.

Whole of Class I — Treatment:

- Adequate — 25—average period of disability 9.8 months.
- Inadequate — 23—average period of disability 8 months+
- None — 13—average period of disability 15 months+

52 males.
9 females
Average age 40+.
Average time after accident when seen by Impartial Examiner, 11 months—minimum period of disability.

CLASS II.

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability.	Diagnosis	Treatment
M	45	Laborer	Bale of hay fell on back	5 months	Contusion back	None—Has had no treatment. Still disabled partially. Traumatic hysteria.
M	16	Laborer	Ladder fell across back	1 month	Contusion back	None—No longer disabled.
M	42	Laborer	Concrete roof fell on him	2 months	Contusion back	None—Rest in bed. No disability.
M	38	Teamster	Struck by box	2 months	Contusion back	None—In bed two weeks at home. No other treatment. No disability.
M	27	Teamster	Struck by coal screen	1 month	Contusion back	Inadequate—Strapped twice. No further treatment. No disability.
M	61	Laborer	Struck by paving stone	8 months	Contusion back	Inadequate—Massage and baking for a month. Not disabled.
M	47	Laborer	Struck on back by dirt	4 months	Contusion back	None—Traumatic hysteria. Not disabled.
M	40	Carpenter	Struck by timber	1 month	Contusion back	None—Tender in sacro-iliac region. Still partially incapacitated.
M	16	Teamster	Struck by wheel hub	1 month	Contusion back Question of hernia	Inadequate—Sticking plaster. Went to work in three weeks. Had a large double hernia preexistent to accident.
M	73	Steamfitter	Steampipe fell on back	36 months	Contusion back. Arthritis	None—no work since accident. Arthritis preexistent. Senile.
M	43	Laborer	Trench caved in on him	7 months	Contusion and back strain	Adequate—Bed three weeks and jackets. No bony injury. Strapped once. Traumatic hysteria at present. Condition at present postural and mental. Having no treatment.
M	23	Laborer	Trench caved in on him	3 months	Contusion back	None—No longer disabled. Not at work.
M	54	Teamster	Kicked by horse	3 months	Contusion back	None—Has done no work. "No strength in back." Not disabled.
M	55	Laborer	Bag of cement fell on back	2 months	Contusion back	Adequate—Bed three weeks, liniment, strapping. Well, not disabled.
M	39	Laborer	Struck by falling concrete	16 months	Contusion back	None—After accident arrested and in jail hospital ten months. Still disabled.

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability.	Diagnosis	Treatment
M	42	Laborer	Struck back against wall	16 months	Contusion back	Practically none—Liniment and strapping. At work in ten days. Still complains of stitch in back.
F	21	Factory	Machine struck back	7 months	Contusion back	Inadequate—In bed a week. Occasional strapping. Still has backache. Partially incapacitated.
M	55	Laborer	Struck by hand truck	5 months	Contusion back. Arthritis	None—Disabled, but due to Hypertrophic arthritis.
M	34	Laborer	Steam hammer hit back	3 months	Contusion back	Inadequate—Liniment at first, later strapped and a belt. Still partially disabled.
M	45	Chauffeur	Struck by auto seat	4 months	Sprain of back	Adequate—no present disability.
M	29	Laborer	Load of dirt fell on back	1 month	Contusion back.	Inadequate—Well, not incapacitated.
M	48	Laborer	Kicked by horse. Immersion	3 months	Contusion back. Fractured collar bone	Inadequate—In bed two weeks. Back at work on streets.
M	46	Longshoreman	Crushed by bags of sugar	7 months	Contusion back	Inadequate—Traumatic neurosis. Not disabled.
M	28	Laborer	Struck by paper bailer	3 months	Contusion back	None—Not disabled; disinclined to work.
			FRACTURED SPINES			
M	29	Truckman	Bag of flour fell on back	8 months	Fractured 1st lumbar	Inadequate—Back strapped; in bed 17 days. Jacket for 1 month. No treatment since. Kyphos-permanent partial disability.
M	31	Laborer	Struck by falling timber	36 months	Fractured 1st and 2nd lumbar	None—Diagnosed as tubercular spine. Kyphos; now wearing a corset. Partially disabled.
M	62	Teamster	Jammed between wagon seat and electric shovel	24 months	Fractured 5th lumbar. Pedicle	None—Furnished with a belt after a year. No medical attention. Partial disability.
M	30	Laborer	Wooden staging fell on him	1 month	Fractured 1st sacral lamina	None—Hospital four days. No other treatment. Went back to work two months later at increased wages, but still has occasional pain in back.

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability.	Diagnosis	Treatment
M	51	Laborer	Back forcibly flexed	43 months	Fractured 1st lumbar	Inadequate—Kyphos. Fracture went untreated and unrecognized for a long time. Still partially incapacitated.
M	39	Laborer	Struck by derrick block	6 months	Fractured 6th cervical vertebra	Inadequate—Neck now normal. No disability.
M	48	Teamster	Run over by wagon	2 months	Fractured 4th transverse processes of 4 lumbar vertebrae	Inadequate—Ruptured kidney; bed eight weeks. No further treatment. Still disabled.

Treatment:
- Adequate 3—average period of disability when seen 3 months+
- Inadequate 12—average period of disability when seen 7.5 months
- None 16—average period of disability when seen 9.8 months

Average time after accident when seen by Impartial Examiner—8 months+.
30 males.
1 female.
Average age—40 years+.

CLASS III.

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability.	Diagnosis	Treatment
M	43	Laborer	Pushing a truck	2 months	Back strain	Inadequate—Back strapped after 2 weeks. Felt something snap in back. Partially incapacitated.
M	53	Baker	Slipped	5 months	Back strain	Inadequate—Occasional strapping and later occasional massage. No disability.
M	27	Laborer	Lifting piece of concrete	12 months	Back strain; question of muscle tear	Adequate—Felt something give way in back. Strapped; jacket, belt, and brace. No disability.
M	55	Laborer	Lifting a lathe	3 months	Back strain; question of muscle tear	Adequate—Legs gave out. Strapped; cast and back brace. Partially incapacitated.
M	25	Machinist	Twisting strain	20 months	Back strain	Adequate—Probable malingerer. No evidence of injury at present.
M	54	Carpenter	Lifting heavy lumber	52 months	Back strain; arthritis	Adequate—No work since in July. No pain in back for one year after accident. Disability due to arthritis.
M	42	Pressman	Lifting 200 lbs	3 months	Back strain; question of muscle tear	Adequate—Hospital two weeks. Strapped; jacket and belt. No present disability.
M	40	Fireman	Shoveling coal	9 months	Back strain+	None—went to work 6 months after accident firing a furnace. No disability.

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability.	Diagnosis	Treatment
M	54	Boat-builder	Lifting lumber	1 month	Back strain+	Inadequate—Bed 3 days; liniment. No longer disabled.
M	39	Laborer	Lifting a stone	4 months	Back strain+	Inadequate—Not disabled; mental.
M	42	Laborer	Lifting a water pipe	8 months	Back strain+	Inadequate—Pain in back ever since accident. Strapping and belt (6 inch). Still disabled.
M	43	Teamster	Lifting heavy load, 400 pounds	8 months	Back strain+; question of sacro-iliac	Inadequate—Felt snap in back. Strapped; loose belt. Still disabled.
M	29	Steamfitter	Holding heavy weight	4 months	Back strain+	None—Felt something give in back; could not straighten up. Porous plasters, etc. Partially disabled.
M	29	Laborer	Lifting iron	1 month	Back strain	Inadequate—One strapping a week after accident. Still disabled.
M	43	Steamfitter	Carrying a radiator	3 months	Back strain	None—Felt something snap. Rest in bed a week; has tried to work. Still disabled.
M	42	Janitor	Lifting ashes	1 month	Back strain	None—Still partially disabled.
M	34	Carpenter	Lifting iron beam	10 months	Back strain	Adequate—Strapping, cast and belt. No longer incapacitated.
M	46	Iron moulder	Lifting pattern case	13 months	Back strain	Adequate—Bed 2 months; then cast and back brace. Been at work since 4 months after accident. Not disabled.
M	49	Carpenter	Lifting wooden blocks	1 month	Back strain; contusion	Inadequate—Strapped once. Still partially disabled.
M	15	Laborer	Lifting a barrel	2 months	Scoliosis	None—Had no injury, but did have bad structural scoliosis. No disability.
M	31	Shipper	Lifting heavy material	4 months	Back strain; question of sacro-iliac	Inadequate—Stooping over; felt something give. No work since accident. Strapped and a belt later.
M	35	Laborer	Sudden pull on back muscles	4 months	Back strain; question of tear	None—Occasional strapping. No work. Partially incapacitated.
M	41	Laborer	Lifting a sand scoop	1 month	Back strain	Inadequate—Strapped once. Hospital 6 days. Partially incapacitated.
M	?	Laborer	Lifting a barrel	4 months	Back strain	None—No disability.
M	30	Grocery clerk	Lifting box	1 month	Back strain	Inadequate—Something gave way. Strapped for 3 weeks. No disability.
M	80	Janitor	Slipped and strained back	6 months	Back strain	None—No work since accident. Still partially incapacitated.
M	30	Laborer	Lifting a barrel	3 months	Back strain	Inadequate—No work since; one strapping. Still incapacitated.

Sex	Age	Work	Injury	Time after accident seen by Impartial Examiner. Minimum period of disability.	Diagnosis	Treatment
M	39	Laborer	Lifting a box of steel	24 months	Back strain; question of Hypertrophic arthritis	Adequate—Had arthritis of spine which was cause of disability. No work since accident.
M	32	Carpenter	Lifting concrete	9 months	Back strain	Inadequate—Pills and iodine. Working since 4 months after accident at previous occupation.
M	44	Carpenter	Lifting timber	2 months	Back strain	Adequate—Wore a belt part of the time; back at work. No disability.
M	62	Laborer	Lifting strain	1 month	Back strain	Inadequate—Strapped several times. Still partially disabled. Age a factor.
M	33	Teamster	Lifting coal	3 months	Back strain	Inadequate—No doctor for three weeks. Strapped once. Some work off and on. Really laid up only 7 weeks. No disability.
M	39	Laborer	Lifting stove	4 months	Back strain; question of sacro-iliac	Inadequate—Strapped twice. Went to work 16 months after accident.
M	43	Teamster	Lifting bag of potatoes	4 months	Back strain	Adequate—Jacket; went to work 3 months after accident. Still pain in back. No disability.
M	24	Electrician	Lifting timber	13 months	Back strain	Adequate—Frame treatment. Back brace. No longer incapacitated.
M	29	Laborer	Lifting a railroad tie	3 months	Back strain	None—Bed at home 2 weeks. No disability.
M	46	Grocery clerk	Stepped off wagon	5 months	Back strain	Inadequate—Went to work 10 months after accident. Wears a belt occasionally. No further disability.
M	39	Longshoreman	Lifted bar of steel	1 month	Back strain	Inadequate—Liniment and occasional strapping. Still incapacitated.
M	50	Wheelwright	Wrenched back	14 months	Back strain	Adequate—Wears a leather jacket. Still incapacitated.
M	34	Candy cook	Lifting tub of syrup	5 months	Back strain	None—No disability. Has worked off now.
M	42	Laborer	Lifting timber	1 month	Back strain	Inadequate—Liniment; occasional strapping. Still disabled.
M	35	Laborer	Shoveling dirt	2 months	Back strain	Inadequate—Occasional strapping. Still partially disabled.

Treatment:
- Adequate 12—average period of disability when seen 14.1 months
- Inadequate 20—average period of disability when seen 3.2 months
- None 10—average period of disability when seen 4.1 months

Average time after accident when seen by Impartial Examiner—5.9 months.
42 males.
Average age 40 years.

Editorial

TIME SAVING AND DISABILITY PREVENTION FOLLOWING INDUSTRIAL ACCIDENTS

Orthopedic surgeons more than ever before should be taking a definite place in the care of those injured in the industries. The experience of base hospitals and reconstruction hospitals during the war has amply shown that the Orthopedic Department has always something to bring to the Surgical Service. It has been shown that by the application of principles which have governed for years in the practice of Orthopedic Surgery there are not only prevention of deformity and lessening of disability but actually shortening of the length of time necessary for hospital care. It is now admitted that wounds heal more promptly when anatomical readjustment of damaged parts is made immediately following the injury tho often replacement has been made more with the purpose in mind of conserving ultimate function of the parts involved.

Recent articles like that of Trask in Modern Medicine (October, 1919) and that of Sever in this Journal (November, 1919) are sure to attract the attention of employers in industrial concerns where many accidents occur. Sever has abundantly emphasized the shorter period of disability and hospital care necessary for cases which he classifies as adequately treated. Trask speaks very plainly of the evil consequences which follow failure of early accurate diagnosis or when incompetent surgeons failed to provide the kind of care which the injuries require. Especially in fractures and in back injuries the principles which govern in orthopedic treatment have been shown to be essential, if early good results are to be obtained.

Orthopedic surgeons should in their various communities endeavor to demonstrate by local conditions the importance of prompt diagnosis and adequate care in these cases. While there has been a considerable widening of the influence of orthopedic surgery in the medical profession employers of labor are just beginning to hear of the possibilities of true reconstructive surgery. It is idle for orthopedic surgeons to remain modestly silent waiting for this impression to spread itself. The message should be carried to employers and workers, all of whom will be benefitted by a wider adoption of reconstruction surgical methods applied to the victims of these accidents.

Items of Interest to Orthopaedic Surgeons

Dr. George W. Hawley announces that he has opened an office for the practice of orthopedic and fracture surgery at Eleven East Forty-eighth Street, New York City.

Dr. John Dunlop, formerly of Washington, D. C., wishes to announce that he has established his office at 820 Baker-Detwiler Building, Los Angeles. Practice limited to Orthopedic Surgery.

Dr. C. B. Francisco has returned from overseas. He has opened an office at 416 Argyle Building, Kansas City, Missouri, where he will resume his practice in Orthopaedic Surgery.

Dr. Frederick C. Kidner, recently orthopaedic consultant of Base Section 3, A. E. F., has resumed the practice of Orthopedic Surgery. Office at 1337 David Whitney Building, Detroit, Michigan.

Dr. Robert B. Osgood has resumed his practice of Orthopedic Surgery at 372 Marlborough, Boston, after more than two years absence on military duty.

Dr. E. D. McClean announces his discharge from service overseas and return to private practice at Des Moines, Iowa, which will be limited to Orthopedic Surgery and Consultations.

Dr. Carroll L. Storey announces his separation from military service and the opening of offices for the practice of Orthopedic Surgery at the Empire Building, Detroit, Michigan. Dr. Storey was assigned for duty with the British by the Red Cross before the entry of America into the war. He returned to the United States in 1917 and was commissioned in the United States army.

Dr. Phil Hoffman and Dr. F. H. Albrecht have formed a partnership for the practice of Orthopaedic Surgery. 3657 Delmar Boulevard, St. Louis.

Col. W. E. Cooper, who was commanding officer at the Savenay Hospital Center, is now in charge at Fort Bliss, Texas.

General Sir Robert Jones was entertained by the orthopedic surgeons of Chicago following the meeting of the College of Surgeons in New York City.

MEETING OF THE PHILADELPHIA ORTHOPAEDIC CLUB

A meeting of the Philadelphia Orthopaedic Club was held on Thursday evening, November 20th, 1919, at the Philadelphia Orthopaedic Hospital and Infirmary for Nervous Diseases.

Dr. William J. Taylor presided.

Cases were shown by Drs. Gill, Crosson, Mutschler, Leavitt, Burr, Ashhurst and Owen.

Twenty-one members of the Club were present, and there was a general discussion of all cases by the members.

DeFOREST P. WILLARD,
Secretary.

THE SAMUEL D. GROSS PRIZE

FIFTEEN HUNDRED DOLLARS

Essays will be received in competition for the prize until January 1, 1920.

The conditions annexed by the testator are that the prize "shall be awarded every five years to the writer of the best original essay, not exceeding one hundred and fifty printed pages, octavo, in length, illustrative of some subject in Surgical Pathology or Surgical Practice, founded upon original investigations, the candidates for the prize to be American citizens."

It is expressly stipulated that the competitor who receives the prize shall publish his essay in book form, and that he shall deposit one copy of the work in the Samuel D. Gross Library of the Philadelphia Academy of Surgery, and that on the title page it shall be stated that to the essay was awarded the Samuel D. Gross Prize of the Philadelphia Academy of Surgery.

The essays, which must be written by a single author in the English language, should be sent to the "Trustees of the Samuel D. Gross Prize of the Philadelphia Academy of Surgery, care of the College of Physicians, 19 S. 22d St., Philadelphia," on or before January 1, 1920.

Each essay must be typewritten, distinguished by a motto, and accompanied by a sealed envelope bearing the same motto, containing the name and address of the writer. No envelope will be opened except that which accompanies the successful essay.

The Committee will return the unsuccessful essay if reclaimed by their respective writers, or their agents, within one year.

The Committee reserves the right to make no award if the essays submitted are not considered worthy of the prize.

WILLIAM J. TAYLOR, M. D.,
JOHN H. JOPSON, M. D.,
EDWARD B. HODGE, M. D.,
Trustees.

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Current Orthopaedic Literature

LATE RESULTS OF THUMB PLASTY. Emil Shepelmann. *Leitschf Ortho. Chir.*, 1919.

It is of interest to know the late results of a plasty of the thumb done by the author in 1913, four and one half years prior to the present publication. The author has followed up the result of the operation from time to time. By careful re-examinations the original operation was one of auto plasty of the thumb with skin taken from the thorax and the bony center furnished by bone inlay. The operation was carried out in two sittings.

A report on this artificial thumb made about a year after operation reads as follows: The artificial thumb is still without sensation. Between the bone of the artificial thumb and the metacarpus carrying it there is firm bony union. The bone of the artificial thumb carries two sinuses which lead to raw bone.

Further report almost two years after the plasty mentioned shows that the bone of the thumb still carries a small sinus covered by a scab. In regard to sensation there is a zone at the base one centimeter in width within which there is distinct sensation to touch. Other conditions as noted before.

At the end of two years the fistula had closed definitely, but the skin is still livid and bluish. The return of skin sensation has progressed.

Three years after, the sensation had not returned with exception of a small ring which now, however, has a width equal to one and one-half centimeters. The livid discoloration of the skin still persists but the skin appears to be more tough. The skin does not show any tendency to ulceration.

The final result four and one-half years after operation can be summed up as follows: X-ray shows firm fusion of the transplanted bone with the first metacarpal. Examination of sensory function shows that more than half of the artificial thumb is sensitive to touch. The color of the skin is slightly darker than the rest of the hand. There are no ulcerations.

This series of observations show that the functional improvement of the neoplastic thumb progressed slowly but restitution of sensation was not complete four and one-half years after the operation. The author thinks the use of the thumb may be expected to improve and, therefore, disability may be expected to decrease even after a period of years.—*Arthur Steindler, M. D., Iowa City, Ia.*

CENTRAL DISLOCATION OF THE FEMUR (Intra Pelvic Displacement). *Revue D'Orthopedie*, December, 1918.

Under the name of central dislocation there are described cases of penetration of the femoral head into the interior of the pelvis. This lesion is characterized by isolated fracture of the acetabulum and subsequent penetration of the femoral head. Henschen in 1909 collected forty-four cases of inter-pelvic fracture with displacement demonstrated by the X-ray and an additional 64 cases in which the fracture of the pelvis was evident but in which signs of

penetration of the head into the pelvis were absent. To these cases the author adds two of his own observation.

In regard to fracture deformity itself two types may be distinguished:

1. Fracture limited to the floor of the acetabulum.

2. Fracture of the acetabulum with fissures radiating into other parts of the pelvis.

In regard to the injuries to the soft structures, it is remarkable that in spite of the severity of bone injury the round ligament of the femoral head is mostly found intact. Of muscle injuries, there are more often ruptures of the ileo psoas and obturator muscles which are often the cause of intra-pelvic hemmorrage. Contusion of the obturator nerve is not infrequent and is a common cause of the accompanying neuralgia. Of all lesions of the blood vessels those of the obturator and gluteal arteries are mentioned; likewise injuries to the iliac veins.

The most frequent cause of isolated fracture of the cotyloid cavity of the pelvis is fall upon trochanter region from considerable height. In other cases the injury is caused by direct force applied to this region. In exceptional cases the fall upon the feet will transmit the force to the pelvis and cause inter-pelvic fracture.

In the majority of cases the cause is some traumatism which produces fracture of the pelvis forcing the femoral head through the floor of the acetabulum. In a small minority of cases, however, the penetrating of the head into the pelvis is gradually followed by fracture of the pelvis and favored by walking immediately after the injury. Finally there are a certain number of cases in which the wandering of the head into the pelvis does not take place until after considerable time has elapsed after the injury.

One of the cases the author reports illustrates the type of progressive migration of the femoral head into the pelvis following the original injury. The clinical symptoms of central dislocation of the femur present a very characteristic picture. The injured present, aside from the shock of the injury, the picture of absolute functional disability of the extremity involved. That is with a few exceptions in which attempts at walking are undertaken following the injury. The functional disability is almost always complete and upon examination of the patient a flattening of the trochanter region is noticed together with external rotation of the lower limb and rising of the greater trochanter upon Nelation's line. The distance between the greater trochanter and sym physis is diminished. The rectal or vaginal examination often reveals considerable tenderness in the region of the acetabulum. Regarding passive motion, flexion, extension and adduction, are usually present. Abduction and rotation, however, are almost always inhibited. Active motions are absolutely abolished on account of pain. The X-Ray picture does not fail to present characteristic features of the entrance of the head into the pelvis.

Treatment: Immediate treatment consists in reduction of the head of the femur under anesthesia. This reduction should be undertaken as soon as the shock has disappeared. In regard to the maneuvers leading to reduction, simple traction is prefered by some surgeons. Other operators prefer to combine longitudinal traction with lateral traction of the neck of the femur. Others begin their reduction maneuvers by flexion of the thigh upon the pelvis with

an assistant bringing about lateral traction in the direction of the axis of the neck of the femur. The limb is then brought down in extension in a position midway between abduction and adduction.

Open operation has been carried out by Vaughan from an incision identical with one for resection of the hip. The operation is very delicate and difficult. Healing did not take place in his case until after long and continued suppuration and then proper reduction was not obtained. It seems, therefore, after all conservative treatment and bloodless methods will yield better results than open operation.—*Arthur Steindler, M. D., Iowa City, Ia.*

A Contribution to the Study of "Stiff and Painful Shoulder." By Alfred J. Brown, M. D., F. A. C. S., Omaha, Nebraska. *Surg. Gynec. and Obstet.*, Vol. XXIX, October, 1919, No. 4.

It is the object of this paper to suggest that a tear of the tendons of the latissimus dorsi and teres major muscles may play an important role in the etiology of some of the cases of stiff and painful shoulder and also to point out certain therapeutic indications in the disability caused by this lesion.

Symptoms.

After a moderate trauma of rather definite type, usually a fall in which the patient puts out his arm to save himself, or a wrench of the shoulder caused by a sudden motion while the arm is abducted as while hanging on a strap in a street car, or a sudden muscular effort as pitching a baseball before the muscles are accustomed to the required motion, after such a trauma the patient feels a snap in the shoulder, followed by a severe sharp pain and in some cases the arm falls almost helpless by the side. Motion of the arm is extremely painful, especially the movements of abduction and that of external rotation when this is carried out with the arm in a position of moderate abduction. Because of the pain the arm is carried in the sling position and a moderate amount of atrophy of the deltoid muscle supervenes in a short time giving the appearance of nerve involvement.

There is a small range of motion amounting about to 10 degrees which is not painful. This is due to the fact that within this range the injured muscles are not placed on the stretch and consequently are not further traumatized, This symptom serves as a point of differentiation between extra-articular and intra-articular lesions of the shoulder for the latter, where joint surfaces are involved, pain occurs at the very beginning of joint movement.

Pathology.

There occurs as a result of the tear of the tendon a small haemorrhage at the site of injury and later an exudation of serum with the usual oedema a later phenomena of the process of repair. This extravasation in the tendon and beneath the periosteum places the latter on the stretch and makes it tender on pressure and on movement of the arm.

Treatment

In th acute stage the treatment consists of immobilization for a short time; active motion begun early for short periods and always within the limits of

pain; prevention of new insults to injured or reparative structures by splinting the deltoid and inhibiting motion tending to cause such insult (for any motion which does not cause pain may be freely used and will serve to keep up muscle tone); and local and general massage intelligently employed.

In the subacute stage treatment is essentially the same as in the acute except for mobilization. In this stage the patient is best encouraged to use the shoulder as much as possible but always within the limits of pain.

In the chronic and more severe cases it is necessary first to break up the firm scar and fibrous tissue which has formed in the tendons and the adhesions which have formed in the surrounding axillary tissues; also to overcome the shortening of the muscles which have taken place as the result of carrying the arm in the sling position for a considerable length of time. This is best accomplished, as recommended by Codman, by breaking up the adhesions under an anaesthetic.

SUMMARY.

1. Stiff and painful shoulder of a certain type falls into the general class of muscular strain about joints, and this muscular strain centers itself into the tendons of the teres major and latissimus dorsi muscles.

2. The condition manifests itself in (a) pain, produced by stretching the injured muscles; (b) distinct localized point of tenderness over the site of injury in the tendon and at its attachment to the bone; and (c) early development of a moderate amount of atrophy of the deltoid muscle due to the involvement of the circumflex nerve in the inflammatory and reparative processes.

3. The condition is amenable to treatment along lines which have proved successful in similar conditions in other parts of the body. This treatment is conservative and directed toward (a) prevention of trauma, (b) hastening of resolution of oedema and exudative processes, and (c) the formation of a pliable point of union by means of well vacularized connective tissue.— *Leo C. Donnelly, Detroit.*

THE USE OF ORTHOPAEDIC AND PROSTHETIC APPLIANCES IN THE LATE TREATMENT OF WAR DISABILITIES. By A. L. B. LeMesurier, M. D., Orthopaedist, Department S. C. R. *Medical Quarterly.*

The more common disabilities that lend themselves to treatment by appliances may be divided into four classes:

1. Nerve Injuries.
2. Disabilities of the joints.
3. Disabilities of the feet.
4. Amputations.

There are other conditions in which the use of appliances forms part of the late treatment, such as ununited fractures and prolonged suppuration of the joints.

1. NERVE INJURIES.

Most nerve lesions seen are the result of gunshot wounds, but occasional cases are due to contusion of the nerve or to prolonged pressure.

In these nerve cases appliances are used, not for treatment of the nerve lesion itself, but for the treatment of the muscles paralysed, with one of three

objects: (1) to prevent even momentary over-stretching of the paralysed muscles in cases where return of function may be expected, as where the nerve has not been divided or before or after its suture; (2) to prevent or correct deformity caused by contraction of the unparalysed opposing muscles; and (3) to hold the limb in the best position for function.

Whatever the object, the appliance in practically all cases should be worn continuously.

The nerves most commonly injured are the musculospiral, the ulnar and the sciatic, either in its main trunk, or in one of its two divisions.

There is a variable amount of weakness of supination, and practically always a paralysis of the extensor muscles resulting in wrist drop. The wrist should be kept always hyper-extended. To maintain hyper-extension several appliances have been advised, practically all being modifications of the original Jones "cock-up" splint.

Lesions of the ulnar nerve result in inability to separate the fingers and inability to flex the metacarpo-phalangeal and extended the interphalangeal joints. If neglected, the paralysis results in the typical "claw-hand" deformity. To prevent or correct this deformity, the splint used flexes the metacarpo-phalangeal and extends the interphalangeal joints.

Lesions of the sciatic nerve above its divisions may be complete. The resulting paralysis depends upon the site of the lesion, and may involve all the muscles of the leg and foot or the dorsi-flexors, with or without the peroneals, or the plantar-flexors alone. Except in the last-mentioned case, foot drop always occurs, and tends to increase. The treatment, as far as appliances are concerned, consists in maintaining the foot at a right angle with the leg; the position most useful in standing and walking.

2. Disabilities of the Joints.

The disabilities of the joints that lend themselves to treatment by appliances, fall into two main classes. The first class comprises those cases of lack of stability, following ligamentous or bony injury, or excision of the joint. The commoner joints thus affected are the elbow and the knee. In the elbow, lack of stability is usually due to excision, following an infected gunshot fracture involving the joint, an operation that was performed fairly frequently during the war.

Lack of stability at the knee-joint may be caused by injury to some of the ligaments, particularly the crucial ligaments or may be the result of excision of the joint with failure to obtain bony ankylosis. Absolute rigidity of the limb is essential for weight-bearing, and is best obtained by the use of a Thomas caliper splint, with the lower ends of the side bars bent in at a right-angle, and fitting loosely into a tunnel in the heel of the boot, to allow movement of the ankle-joint. The body weight may be diverted from the limb by having the splint long enough to prevent the sole of the foot from quite touching the sole of the boot; the weight being thus transmitted from the boot, through the side bars and ring of the splint, to the ischial tuberosity. This splint gives greater stability to the knee-joint than any other appliance, but it has the disadvantages that it is difficult for the wearer to put on and take off unaided, and that the knee is held at all times rigidly extended. In the minor degrees of instability

a knee-brace is sufficient, with the joint opposite the knee fitted with a stop to prevent extension beyond 180 degrees. Another class of case that may be included here, although not properly a disability of the joint, is that in which, with the joint itself normal, there is a hyper-extension or recurvation of the limb as a result of a fracture of the lower end of the femur, or the upper end of the tibia united with a posterior angulation.

The second main class of joint disabilities in which appliances are useful, is the class in which there is stiffness of the joint, short of bony ankylosis, and in which it is desired to increase movement. This stiffness may be caused by fixation of the muscles above in a large scar—a condition most frequently seen following wounds of the upper arm and thigh complicated by a fracture—or by adhesions in a contraction of the capsular and other ligaments following inflammation or prolonged fixation.

3. Disabilities of the Feet.

Most cases of foot disability due to service, are cases of weak foot or flat foot. Varying degrees of this disability are met with. The least severe and the commonest, are the cases of strain of the muscles, ligaments and fasciae, particularly on the inner side of the foot, due to prolonged marching with a heavy pack, often beyond the point of muscular fatigue. As a rule the foot is quite flexible. The forepart can be actively adducted and the longitudinal arch made prominent; but when weight is borne the arch becomes flattened and the fore-foot abducted. There is pain, particularly after long standing or walking, referred chiefly to the region of the astragalo-navicular joint and up the front of the leg. In practice it is best to advise a patient with such a foot to avoid any occupation that necessitates prolonged standing, and to give him a lift of three-eighths of an inch on the inner side of heel and sole of boot. If there is any tendency for the foot to capsize inward, the heel may be flanged, that is, made wider at the bottom than the top on the inner side. An ordinary well made, leather soled boot, preferably straight on the inside, with plenty of room for the ball and toes, is suitable for this purpose. If the arch of the boot tends to break and flatten, it may be supported by carrying the heel forward about ¾ inch on the inner side.

In cases where the foot is very flexible and the flattening of the arch on weight bearing is extreme, the Whitman plate may be used with advantage.

When the flat foot is accompanied by much pain, muscular spasm and rigidity, it should be forcibly wrenched under an anaesthetic, into a position of inversion, and kept fixed in plaster for about three weeks. At the end of that period, the patient may be allowed up for an increasing time daily, always in a boot with the inner side of the sole and heel raised.

This rigidity due to muscular spasm should not be confused with the rigidity seen in flat feet of long duration. These later are often comparatively painless. A boot raised on the inner side is usually sufficient.

When the valgus deformity is marked, particularly when caused by a badly united fracture about the ankle, an ankle brace may be worn. This consists of a single upright bar, passing up the outer side of the leg, between the heel of the boot and a band around the calf. There should be a free joint either between the end of the brace and the heel of the boot, or at the level of the

ankle joint. A strap, somewhat T-shaped, is sewn by its base to the inner side of the boot. The two arms of the T encircle the ankle, and are buckled on the outside of the metal upright, thus correcting the valgus deformity by pulling the ankle towards the brace.

A second large class of cases requiring treatment by modified boots is that in which there is pain on pressure of the sole over the heads of one or more of the metatarsal bones. This occurs in a variety of conditions, some of the most frequent being metatarsalgia, hammer-toe, claw-foot, hallux valgus, etc. Great relief may be obtained by the use of the metatarsal bar, 3/16-inch or ¼-inch thick and ¾-inch wide obliquely across the bottom of the sole parallel to and well behind the line of the heads of the metatarsal bones.

4. Amputations.

When a stump first heals, there is always a certain amount of oedema present. As this subsides, and as the muscles, particularly those that have no joint to act through, waste, a shrinking of the stump occurs. The shrinking is at first rapid but gradually becomes slower and after a year or more stops entirely. It is best to wait until the first and most rapid part of the shrinking has taken place before supplying a finished artificial limb. With the lower extremity, as soon as the stump can stand it, a peg-leg should be worn; this being for most stumps the best possible treatment. For the thigh, the standard peg, consists of a padded ring like that of the Thomas splint, which grips the stump immediately below the ischial tuberosity on which all the weight is borne. Two metal side bars run down and unite about the knee level to carry the wooden peg, which is armed with a rubber tip. A leather corset encircles the thigh and is laced in front, to tighten as the stump shrinks. The corset should extend to just below the stump and should have a leather hammock slung near the bottom to exert any desired pressure on the end of the stump.

When the stump has shrunk so that there is no obvious oedema, and the muscles have largely lost their flabbiness and become firm—two to four months after healing of the wound—a finished leg may be supplied. As the stump continues to shrink and the bucket becomes loose, additional stump socks may be put on until four or five are worn. The bucket should then be lined with leather, and, as shrinking continues, additional socks again added up to the number of four or five.

Many amputation cases for a renewal of an artificial limb when the fault lies in a surgical condition of the stump. The conditions most apt to cause trouble are a nerve adherent to the scar, a tender nerve-bud, a spur growing from near the end of the bone, or a sequestrum buried in the stump. It is usually a waste of time to fit such cases with new limbs. The condition should be given time to subside, or should be treated surgically, before the attempt is made.

The material used for the bucket is important. It has been well established by practice that the bucket made of some rigid material, so fashioned as to take pressure on selected points and to avoid others, is preferable to the bucket made of material that is yielding, and takes pressure from all points evenly.

The simplest type of artificial leg is that used for amputations at, or a little below, the middle of the thigh. The points most likely to cause trouble

from pressure are the perineum, the tendon of the adductor longus which becomes prominent as the stump is swung forward, the great trochanter and, more rarely, the femoral vein.

For disarticulations thru the hip-joint, a device called the "tilting table" is employed. This is a basin-shaped piece of willow, made to conform to the hip region and to take pressure chiefly from the ischial tuberosity. It is fastened by a broad leather band to the pelvis, and follows it in all its movements.

The artificial arm makes a very poor substitute for the natural limb. The reason for this is the variety and complexity of the movements normally performed by the arm and hand. As a rule an artificial arm can be supplied, provided the stump is a fair length, fitted with a special appliance which will permit the wearer to do one single action moderately well; but no appliance yet produced can begin to copy the variety of movements of the normal hand. The nearest approach to the general usefulness of the natural hand, is obtained by means of one or the other of the various hooks.

The tendency in artificial arms is all towards simplicity and lightness. For work, in both above—and below—elbow amputations, the "working arm" is used. This consists in its simplest form of a leather bucket for the stump, kept in position by suitable harness, with a hook attached directly to its end.

Much ingenuity has been shown in devising special terminal appliances for artificial arms, usually with the object of assisting the wearer to perform some special act. These appliances are often useful, but only to those men whose work consists in the frequent repetition of the single action.—*Leo C. Donnelly, Detroit.*

FRACTURES OF THE LOWER THIRD OF THE FEMUR. Joseph Van de Velde, M. D. *Annals of Surgery*, October, 1919.

To overcome the usual deformity of backward displacement of the lower fragment the author uses in certain cases the following methods:

1. Wiring the fragments, in cases with little or no comminution.
2. Traction on the femoral condyles by the use of ice tongs, Steinman pins, or Willems screws, when there is considerable comminution.
3. Depages method of vertical suspension of the lower fragment, combined with horizontal traction on the leg is used in all the other types where the first two methods are not used. Where there is cancellous bone the use of the Willems screws has not been satisfactory.—*Custis Lee Hall, Washington, D. C.*

GUNSHOT FRACTURES OF THE HUMEROUS TREATED BY SUSPENSION AND TRACTION. Morris K. Smith, M. D. *Annals of Surgery*, October, 1919.

An excellent article well illustrated, giving the author's experience with gunshot fractures of the humerus at American Red Cross Hospital No. 2, under Colonel Joseph A. Blake, M. C. The use of traction and suspension without a fixed splint is used, and the fragments are controlled by the amount of traction and countertraction that is used. The humerus is placed in abduction, and the elbow flexed at ninety degrees. The advantages claimed for the method are, first, maintenance of favorable position from the point of view of drainage;

second, ease and simplicity of dressings; third, comfort of the patient; fourth, control and maintenance of reduction; and fifth, earlier restoration of function. About 152 cases were treated in the series.—*Custis Lee Hall, Washington, D. C.*

PAIN IN THE LUMBOSACRAL REGION ASSOCIATED WITH CONGENITAL MALFORMATION OF THE TRANSVERSE PROCESSES OF THE FIFTH LUMBAR VERTEBRA. By Andre J. Richards, M. D., Roentgenologist to the New York Orthopaedic Hospital, New York City. *The American Journal of Roentgenology*, Vol. VI, September, 1919, No. 9.

Examination of about 60 patients complaining of pain in the lumbosacral region has shown that 10% did not present abnormalities. Of those 60% were slight or pronounced malformations of the transverse process of the fifth lumbar vertebra. We classify them in four different groups, each case presenting one or several characteristics of a particular group:

First Group—One or both transverse processes are longer and larger than normal; they may apparently be in contact with the sacrum and iliac bones. Their shape sometimes suggests a change directly traceable to this contact; or the formation of a bursa at the point of contact is indicated.

Second Group—One or both fifth lumbar transverse processes are very markedly long or large and seem to have taken an oblique upwards direction from contact with the sacrum and iliac bones; the space between the lower border of the process and the upper border of the sacrum appears very narrow and sometimes it has entirely disappeared.

The two preceding groups are not so much true malformations of the transverse processes as malposition of the bones of the pelvis; the sacrum is apparently situated very low between the iliac bones. This is more frequent in males than females.

Third Group—This group is represented by the very marked enlargement outwards and downwards of the 5th lumbar transverse processes which present a size two or three times that of the process of the opposite side, its shadow overlapping the shadow of the upper part of the iliac bone and sacrum, with sometimes the presence of a bursa, but no actual joint formation.

Fourth Group—This group would include the malformation of one or both fifth lumbar processes which are considerably larger than normal and united with the upper part of the sacrum by a true joint.

In all cases the vertebra bearing the malformed process or processes is a true fifth lumbar, the sacrum showing the regular number of segments and the transverse process of the vertebra above presenting the characteristic aspect of the fourth lumbar.

We may consider the pain as being produced either:

1. By compression of soft tissues, muscular or fibrous between the bony parts.
2. By irritation and arthritis of normal or abnormally formed bursae and joints.
3. By the slow acting strain on ligaments when a very slight relaxation of

the joints of this region is produced, these joints normally allowing extremely limited movements.

4. By pressure or tension due to the persistant malposition of the bones on different segements of the trunks of the nerves which emerge from the lateral foramen of the fifth lumbar vertebra, especially of the lumbosacral cord.

Until the ossification is nearly completed, real contact between a large fifth transverse prccess and the sacrum or illium is not produced or the tissues which come in contact are not hard, and yield easily to pressure. The abnormal joint or bursa is not formed. With the completion of ossification, if the pressure of the enlarged prccess is made on the sacrum, there may be a tendency to lateral tilting of the fifth lumbar and, in the upright position, a tendency to compensatory opposite tilting of the sacrum, which causes strain on both sacro-iliac joints and subsequent arthritis, this arthritis being generally more marked on the side opposite to the malformation. Arthritis also is generally more marked on the side cppcsite the malformation. When the malformation is unilateral the patient generally complains of pain over the region of both sacro iliac joints, the pain often being more severe on pressure of the joint oppcsite the malformation. The pain radiated to the hip, buttock, ischiatic region, also to the thigh and leg, is generally felt on the same side as the malformation.

The roentgenological conclusions about the position of the bones of the lumbosacral region can rarely be arrived without making several plates taken from different angles, above and below the level of the upper border of the sacrum. The stereoscope does not seem to help a great deal in this investigation. The lateral view is not of great value as far as the examinatien of the fifth lumbar processes is concerned, but is of first impcrtance, when obtainable, to appreciate the extent of spondylolisthesis or the degree of the backward tilting of the sacrum.—*Leo C. Donnelly, Detroit.*

THE BARREL-STAVE SPLINT IN FRACTURE OF THE CLAVICLE. By Hubert A. Royster, M. D., Raleigh, N. C. *Annals of Surgery*, Vol. LXX, October, 1919, No. 4.

To apply the barrel-stave splint to a fractured clavicle, the center of the stave is found, and this should be placed over the center of the patient's manubrium, at the suprasternal notch. The stave is then sawed off at each end to fit just inside the head of each humerus while the shoulders are drawn backwards. One inch from each end a nail is driven into, but not through, the splint. The splint is then padded with cotton, retained by a bandage, and placed in a posi tion as first measured, the concave surface being next to the chest. While the splint is held in place and the shoulders kept firmly back, bandages are tied to the nails, carried under each axilla and crossed on the back in the figure-of-eight fashion; as many turns are made and the stave is drawn as tightly as necessary. If there is a tendency of the splint to turn or to slip, adhesive plaster may be applied to reinforce the bandage. If the patient is a heavy, muscular subject, the arm is put into a sling.

The appealing quality of this dressing is its comfort. The patient may use his hands and forearms at will without disturbing the fragments, and he is

relieved of the distress which the older dressings give. We have been told that the deformity in fracture of the clavicle is produced by "the action of the powerful muscles attached to the scapula." It is due, not so much to the pull of the muscles, as it is to the dropping downward and inward of the shoulder by its own weight.—*Leo C. Donnelly, Detroit.*

RADIOGRAPHIC DIFFERENTIAL DIAGNOSIS OF BONE AFFECTIONS IN INFANCY AND CHILDHOOD. Julius H. Hess. *Medical Clinic North America*, 1919, III, 31.

Osteogenesis imperfecta tarda.—The radiograph shows: Multiple fractures, mostly intraperiosteal; excessive callus; thin shadows cast by all bones due to the lack of density of osseous tissue; no curving or bending of the long bones; cortex thin or apparently absent in some places, irregular thickness with no thickening on concave side of shaft; medullary canal enlarged and shows mottled shadows.

Rachitis.—The radiograph is not absolutely necessary to diagnosis but is valuable in following the effect of treatment. The plate usually shows: Thin shadow, due to diminished calcium content; fractures are usually present but are complete and there is very little formation of callus; bowing is characteristic especially in the lower limbs; the cortex is about the same as in osteogenesis imperfecta except that there is definite thickening on the concave side, almost pathognomonic; epiphyses show broad flaring and cupping of the epiphyseal end of the diaphysis, irregular enlargement of the entire epiphysis but decrease in density.

Scorbutus.—An irregular circumscribed shadow of variable density at the end of the diaphysis, due to hemorrhage, is a characteristic finding in this disease. If congenital syphilis is excluded, this shadow may be considered as pathognomonic. Subperiosteal shadows from deposit of osteophytes at the seat of the hemorrhage are also seen but are less constant than the epiphyseal shadow. Fractures are less common.

Tuberculosis.—The plate shows bone atrophy in very early stages of the disease. Within the active zone the spongiosa appears to be washed out, and if the focus is near the periphery the bone appears as if absorbed. Callus is very deficient. The periosteum in the neighborhood of the lesion appears as if sparated from the cortex, due to subperiosteal new bone granulation tissue. The surface of the underlying compact bone is smooth; if it should be rough and irregular, one should think of periosteal sarcoma rather than tuberculosis. This is quoted from Frazer.

Osteomyelitis does not give a conclusive diagnostic picture in the X-ray before the end of the second week. After that time a periosteal proliferation and new periosteal bone formation shows up near the diseased area. A positive diagnosis can be made when a sequestrum can be outlined. A very extensive ossifying periostitis is also present by the time the sequestrum appears.

In chronic osteomyelitis the plate shows patches of varying density due to rarefaction and collection of debris and pus. Dense shadows will be seen from

layers of dead cortical bone. These have a definite periphery beyond which are the lighter shadows of the living bone.

Sarcoma gives a shadow of absorption with no periosteal reaction or new bone formation. If medullary there may be shadows resembling spicules, or islands of bone with little or no normal bone remaining in the immediate neighborhood.

In syphilis the picture varies with the age of the infant. In the first weeks of life the pathognomonic osteochondritis syphilitica produces "either a homogenous transverse shadow or a streak interrupted by transverse streaks at the epiphyseal line." Later deep shadows along the outer surface of the cortex are produced by the ossifying periostitis which is present at that stage. The older the infant the less marked the shadows of osteochondritis and the more marked those of periostitis. The findings in syphilis may resemble those of osteomyelitis but the lesions of the former are usually multiple. In the healing stages of syphilis there may be cupping of the epiphyses as in rachitis, but this will be irregular in different joints and not uniform as in rachitis.—*William Arthur Clark.*

RAPIDLY FATAL SPINAL. M. A. Caries, M. D., Dublin, M. R. C. P., London. *British Medical Journal*, Saturday, August 30, 1919.

Three cases were reported somewhat similar. Case 1, Aged 26, reported sick call April 28, 1917, on account of pain in back but carried on until April 30, when he became weak in legs. Admitted to hospital May 1, unable to stand due to paresis, later same day complete facial paralysis, both legs, knee and ankle jerk absent plantar feeble. Anaesthesia over greater part of legs.

Motor and sensory reflexes of both arms normal, pupils normal and reacted to light and accommodation. Lumbar puncture gave nothing distinctly abnormal. The day following anaesthesia had extended to umbilicus. Temperature 105, Lumbar puncture fluid straw colored from blood leucocytes, later polymor phonuclear leucocytes and a few micrococci were found.

The patient became delirious, unconcious and died May 5.

Post Mortem.—Body of powerful, well developed man, no emaciation. Spinal canal a considerable amount of thick yellowish pus was found extradurally extending up as far as fourth dorsal and down to tenth dorsal process most active at ninth dorsal. The upper and lower surfaces were most involved, however the sides of the vertebrae were involved, the right more than the left.

Lungs bound down by adhesions. Numerous military tubercles were found in upper and lower lobes, both lungs involving pleura. There was no consolidation, cavitation or caseation, or other evidence of old tuberculosis.

No pus from spinal canal gram and stapylococci were seen. This was the most rapid of the three cases, the other two terminating fatally at 9 and 15 days responsively. In all, the onset was swift and without warning.

The writer suggests the cases of this type might chance to have no small medico-legal significance in civil life.—*James R. Elliott, Kansas City, Mo.*

PHASES OF WAR SURGERY: BONE TRANSPLANT: FROM THE TIBIA TO THE LOWER JAW FOR LOSS OF SUBSTANCE. By Chas. A. Powers, M. D., Lieut. Col., M. R. C., U. S. Army, Denver, Colo. *Annals of Surgery*, Vol. LXX, October, 1919, No. 4.

CASE 1, INJURED AUGUST, 1915—There was pseudarthrosis of the right side of the body of the lower jaw, with apparently considerable loss of substance. Heavy, dense scar tissue on the right side of face in the region. Widest possible preliminary removal of this cicatrix.

July 16, 1917. Bone transplant. (On the preceding day dental splints had been applied, and "open-bite" supports applied in the usual way.) The entire region of lost bone was a dense mass of hard cicatricial tissue, despite the preliminary attempt at excision of the scar. This cicatricial tissue was removed as much as possible, great care being taken to avoid opening the oral cavity. Posterior fragment exposed, it being much drawn in by the ptergoid muscles. Very careful dissection of the soft parts from the bone especially at the end of the fragment where it was solidly fibrous and densely adherent. Anterior fragment exposed and cleared. Loss of substance was found to be over two inches. Seat made in posterior fragment by Albee saw and chisel, care being taken to go down into bleeding bone. Seat made in anterior fragment, but this is difficult because of dense eburnation of bone. Cultures proving negative taken from each cut in bone. Dry wound secured. Fragment of suitable length taken from tibia by twin saw, the periosteum being so raised laterally as to drop over sides of fragment. Ends of graft beveled so that the periosteum dropped over these obliquely cut ends. Transplant applied to lower jaw, held in place by forceps, and the soft tissue carefully sewn over it by interrupted sutures of fine black silk. The sutured soft parts held the fragment in place, but the fragment did not "wedge" into the two portions of the lower jaw proper. Covering of transplant difficult in this case because of the density of cicatricial tissue. Subcuticular stitch to skin without drainage. Very large, firm, carefully applied dressing, with heavy crinoline support. Leg put up in plaster-of-Paris for six weeks. Each subsequent dressing done with the detail of an aseptic operation. Smooth course. Inter-dental supports and splints removed at the end of three months and solid union found throughout. Patient re-examined from time to time for one year from date of operation. The union held. Function of jaw practically perfect.

Results—Eleven transplants made on ten patients, one case being double. In these eleven operations there were three infections, each infected case being followed by loss of the graft. Results in the eleven cases: 7 cases, or 63 plus per cent. of complete successes; 3 or 27 plus per cent. of complete failures; and 1 case, 9 per cent. undetermined, but a probable success when last seen in June, 1918. The conditions of success embraced absolutely solid consolidation, excellent dental approximation, good mastication of not too hard food, and a good speaking voice.—*Leo C. Donnelly, Detroit.*

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